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ARNOLD ARBORETUM
HARVARD UNIVERSITY



BULLETIN
OF POPULAR INFORMATION

SERIES 4. VOL. V

APRIL 2, 1937

NUMBER 1

THE FORSYTHIAS

FORSYTHIAS are among the most common of garden shrubs, and their early yellow blossoms are a boon to many a dreary garden which has looked lifeless a greater part of the winter. They were first introduced into America about 100 years ago. Probably no other hardy wood shrubs which have been introduced from the Old World into our gardens can equal or surpass the forsythias in cheerful beauty, which is developed at a season when there are comparatively few other competitors so attractive.

All the plants in this genus have yellow flowers which open in late March or early April before the leaves appear. All can be grown in many different types of soil and can withstand the tough, trying conditions of the city garden better than many other shrubs. Only one, the green-stem forsythia (*Forsythia viridissima*) has autumn color, and this is a lovely purplish red.

Unfortunately many public plantings of forsythias are sadly mutilated because of lack of intelligent care in pruning. Forsythias should be given plenty of room in which to grow and expand. They should not be crowded closely together for any reason except to make a good, dense bank planting where the whole object is to cover the ground. Many times when a single bush is used, it will be placed only two or three feet from a walk when actually it should be placed 8 to 10 feet from the walk, in order to give the plant plenty of room to expand fully at maturity. If the plants are pruned from the side, this necessarily cuts off the lovely drooping branches and spoils the entire effect, leaving only the unsightly base and a few branches ending prematurely in mid-air when they should be allowed to arch gracefully toward the ground.

Pruning. Forsythias should be pruned only after flowering. This is not because of anything peculiarly inherent in the plant itself, but simply because the flower buds are present all winter long, and if the plant is pruned before it flowers a large proportion of the buds would be needlessly destroyed before they have an opportunity to open. Consequently, it is always better to leave the plants alone until they have blossomed, and then, if necessary, do the required pruning. Also, after the flowers are gone the young shoots commence active growth, and such pruning as has been necessary will be considerably less apparent. It is usually best when pruning forsythias to leave as many of the graceful side branches as possible.

Fortunately, forsythias, like lilacs and privets, when necessary, can withstand the most severe pruning. As an example, this spring at the Arboretum it was necessary to cut off one of our bank plantings of forsythias to the ground, because it had become so overgrown that it was a physical impossibility to cut out only the dead wood. Because of the large amount of dead wood and the overgrown condition of the mass planting, the shrubs did not bloom nearly as well during the past few years as they should, thus requiring this drastic treatment. These plants will now sprout vigorously from the base and within two or three years will amply repay such extreme treatment by yielding a far superior crop of flowers.

Hardiness. Although the forsythias are classed as hardy, there is a limit to the endurance of such severe temperatures as we often experience in New England. The plants themselves may withstand lower temperatures than the flower buds. It is common, after a severe winter in New England, to see flowers only on those branches which have been protected by the snow during the winter, for it often happens that with temperatures of 15 to 20 degrees below zero, unprotected flower buds will be killed. This has often happened in the Arboretum. There is, however, one forsythia which apparently can withstand these lower temperatures and still bloom. This is the Korean forsythia, *F. ovata*, introduced by the Arboretum in 1917. *F. europaea* has also proved hardy, but its flowers are not as handsome as those of the other species.

Forsythia suspensa. The common type of this species is the variety *Sieboldii*, which is a shrub with very pendulous branches, often touching the ground and rooting at the tip. It was the first exotic forsythia introduced into Europe. It is a native of China and first reached the Netherlands in 1833. Now it is common in cultivation everywhere. There is the vigorous upright growing *Fortunei*, introduced from China in about 1860. In habit this is not nearly so droop-

ing as var. *Sieboldii* and cannot be substituted for it, particularly where it would be expected to cover arbors, walls, or to ramble over rocks. Another variety, *F.suspensa pallida*, must have originated prior to 1912 and is simply of value because it has flowers of a considerably lighter yellow than the other type. Although there are several other varieties known (*variegata*, *pubescens*, and *atrocaulis* with its young growth purplish in color), these are not sufficiently outstanding to be strongly recommended and are more tender than the type.

Forsythia viridissima. Robert Fortune is responsible for first sending this plant to Europe from the gardens of China in 1844. It is not as hardy in New England as the other species and often kills severely, even to the ground. It is upright in habit of growth, having the advantage of developing a rather good, dark red autumn color in the fall, a character which most of the other forsythias lack.

The manner in which these plants were first brought from Japan and China has been described in a most interesting way by Robert Fortune. In those days the trip from Japan to England was a long and tedious one around the Cape of Good Hope. The trip was not a matter of a few weeks, but one of four to five months. It was often difficult to keep seeds in a viable condition for that period of time, let alone cuttings and young plants. Then, too, if potted plants were taken there was the problem of protecting them against salt spray and of watering them over so long a period of time, for fresh water on sailing ships was limited.

This difficulty was surmounted by the early plant explorer by using one of the then new "Wardian" cases, which are now more commonly used in the form of solariums. These were simply pieces of glass sealed together so that no air or moisture escaped. Sufficient soil was placed in the base in which to plant the rooted cuttings or young plants. Just before the ship sailed, the plants were well watered and the cases sealed for the trip. In this way the water requirement was decidedly reduced, and even if the plants did occasionally need additional water this could easily be supplied. One of the most important factors was to see that the cases were carefully sealed, not so much to keep the moisture in, but to keep the salt water out. If a very small amount of salt water got in, it would result in serious injury. The sealed cases had to be placed where there was plenty of light, and according to Fortune, "large vessels with poops" were always to be preferred where there was any choice.

Probably more hardy than *F.viridissima* is its Korean relative, var. *koreana*, which was introduced by the Arboretum in 1919 through

seeds sent here by the Department of Forestry in Korea.

Forsythia intermedia. Since forsythias cross freely, hybrids often occur, and *F. intermedia* is one that has proved the most promising. It is a cross between the two Chinese species, *F. suspensa* and *F. viridissima*, originating in Europe shortly before 1880. It is considered superior to both its parents, particularly its very common variety *spectabilis*, which has individual flowers $1\frac{1}{2}$ inches across. This can well be termed the most handsome of all the golden-bells because of its large, dark yellow flowers and the profuseness with which they are borne. It is extremely floriferous, and well-grown stems, 6 to 8 feet long, are literally covered along their entire length with the deep yellow flowers.

Two other varieties are of importance. The variety *primulina*, which originated in the Arboretum in about 1910, has the best pale yellow flowers of any forsythia. The variety *vitellina* is also considered good because of its deep yellow flowers. Since *F. intermedia* is a hybrid, it is sometimes confused with the Chinese species.

As an aid in distinguishing between these plants, two helps are given; a key reproduced from Rehder's *Manual of Cultivated Trees and Shrubs*, and illustrations showing the general outlines of the leaves of the different forms.

Key to Forsythias (After Rehder's *Manual*)

- A. Brs. hollow, with solid pith at the nodes: lvs. often 3-foliate
 - 1. *F. suspensa*
- AA. Brs. at least partly with lamellate pith.
 - B. Mature brts. greenish or brownish: lvs. elliptic-ovate to lanceolate.
 - C. Lvs. serrate, at least above the middle, only occasionally entire, 7-14 cm. long.
 - D. Pith usually solid at the nodes, wanting or lamellate between the nodes; lvs. on vigorous brts. sometimes 3-parted 2. *F. intermedia*
 - DD. Pith lamellate throughout, only at base of vigorous brs. wanting between the nodes: lvs. hardly ever 3-parted 3. *F. viridissima*
 - CC. Lvs. usually entire or with few shallow teeth, 5-8 cm. long, never 3-parted. 4. *F. europaea*
 - BB. Mature brts. yellowish: lvs. ovate or broad-ovate, serrate, never 3-parted. 5. *F. ovata*



PLATE I

F. europaea

F. intermedia

F. viridissima

F. ovata

F. suspensa

Branches of five different Forsythia species showing normal leaf outlines. In identifying Forsythias, these illustrations should be used as an aid only, to the key on the opposite page.

Forsythia ovata. This Korean forsythia is a comparatively recent arrival, having been introduced into America by the Arnold Arboretum in 1917. E. H. Wilson found it growing in the Diamond Mountains in Korea. Although its flowers are smaller and not as numerous as are those of *F. intermedia*, it is the earliest to bloom and hardiest of all the forsythias and for this reason should be used in northern plantings where other species and varieties are subject to winter killing. Its leaves are rounded and ovate. It is not very dense in habit of growth, but eventually forms a well-rounded shrub, 6 to 8 feet tall. The very fact that it is the hardiest should make it valuable to the plant breeder.

Forsythia europaea. This is the only forsythia native of Europe and the only non-Asiatic species. It was first discovered in the mountains of Albania in 1897. The flower buds are proving rather hardy, but it has less ornamental value than any of the others.

NOTES

Friends of the Arnold Arboretum will be glad to note that the number of subscribers to its **Bulletin of Popular Information** is now larger than it has been for many years. Through this medium, the Arboretum is able to reach an ever increasing number of friends. We are always glad to send sample copies to interested individuals and invite our readers to call our attention to those who may profit from it. It is our desire to extend the usefulness of the Arboretum as much as possible.

For the benefit of those who did not subscribe to the 1936 issue in time to receive a complete set, there is still a limited number of the following numbers available at 15 cents each: Tree Troubles, The Flowering Crabapples, Just about Lilacs, Woody Plants with Ornamental Fruits, and Autumn Color. Address the Arnold Arboretum, Jamaica Plain, Massachusetts, for those you wish, enclosing the equivalent of the price in stamps.

Recent Bulletin subscribers for the year 1936 will automatically receive the Bulletin for 1937, since many 1936 issues are exhausted.

The Arnold Arboretum is actively cooperating in the revision of *Standardized Plant Names*, originally published in 1923 and since that time widely used by the horticultural industries. There are now approximately 15,000 new names to be added to the original 40,000 entries. While much detailed work is involved, it is hoped that the revised edition will be available by the first of next year.

DONALD WYMAN



PLATE II

Forsythia intermedia spectabilis

Forsythia ovata

This shows the difference in the size of the flowers between these two species. The flowers of *F. intermedia spectabilis* are the largest and the most profuse of any of the forsythias. The Korean forsythia (*F. ovata*) is the hardiest.

SPRAY PROGRAM AT THE ARNOLD ARBORETUM

	Spray Material	Amount to Apply	When to Apply
Scale insects	Miscible oil	1-15	Feb. 15 to early April
Evonymus scale	“ “	1-30 1-50	when plants are dormant in the summer
Pine-leaf scale	“ “	1-30	early April
Spruce-gall aphids	“ “	1-30	April 15
Larch case-bearer	Arsenate of lead	2 lbs.-50 gal.	when young are feeding
Golden oak scale	Miscible oil	1-15	early spring
Spring canker-worm	Arsenate of lead	2 lbs.-50 gal.	as soon as young appear
Willow leaf beetle	“ “ “	2 lbs.-50 gal.	early June, applied to un- der surface of the leaves
Lace-bug of Rhododendrons	Sunoco oil	1-70 1-60	as they hatch in the spring in August on a partly cloudy day when the tem- perature is not over 80° F.
Elm leaf-beetle	Arsenate of lead	3 lbs.-50 gal.	early June. A second spray may be necessary for a second brood
Red spider on evergreens	Sunoco oil	1-100	applied in summer as a fine mist on a cloudy day when temperature is not over 80° F.
White pine weevil			cut out borers and dead branches
Borers			dig out

L. V. SCHMITT

Because of many new subscribers who were unable to get a complete set of 1936 issues, this Spray Program is being reprinted from the 1936 Bulletin. Wherever a miscible oil is mentioned, recommendations have been based on Sunoco Oil only, which has proved satisfactory at the Arboretum.

ARNOLD ARBORETUM HARVARD UNIVERSITY



BULLETIN OF POPULAR INFORMATION

SERIES 4. VOL. V

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NUMBER 2

SOME SINGLE FLOWERING JAPANESE CHERRIES

WHEN the Japanese cherries bloom in the spring they always lend a touch of exotic beauty and fragrance which is unsurpassed by any other group of flowering trees. In America the public is becoming increasingly conscious of their beauty, and because of the wide publicity given the plantings in Washington many cities and civic organizations are starting local collections. One of the most recent of these, and perhaps the largest, is in the Fairmount Park System of Philadelphia.

Japanese cherries were introduced into America approximately one hundred years ago. Prior to that time it was most difficult to send plant material of any kind out of Japan. In 1846 the old Ellwanger and Barry Nursery Company of Rochester, New York, listed a Japanese cherry in its catalogue, and this was probably the first time any were offered in America. It is probable that the variety first grown here was the pendulous form of *Prunus subhirtella*. In 1912 the Mayor of the city of Tokyo presented to the city of Washington as a token of friendship two thousand Japanese cherry trees, which have done much to promote American interest in these plants. Many of them were planted in Potomac Park in Washington where they are now creating nation-wide interest each spring when they bloom.

Unfortunately, most of the double-flowering Japanese cherries should be considered as comparatively short-lived trees. This is particularly true of many of the double-flowered forms, which often have to be replaced about every fifteen years. Under favorable growing conditions they may last considerably longer, but it is well to consider them as a short-lived group in order to avoid later disappointment. The Sargent cherry is the exception. This is the hardiest of all

and grows to a sizable tree of a ripe old age. One of the first plants in this country, introduced forty-six years ago, is still growing in the Arnold Arboretum and is in perfect condition.

In the colder sections of the United States the Japanese cherries are not hardy, but in general they may be considered as doing well in those places where peaches are hardy. In southern Maine, for instance, they cannot be expected to do well although in the states bordering the Great Lakes, where the temperatures are somewhat moderated, there are some excellent plantings. In the drier portions of the mid-west they soon succumb, but on the Pacific Coast they thrive from Washington to southern California. Even as far south as the middle of Georgia, Alabama, and Mississippi they are perfectly at home.

Propagation. Formerly it was advocated that the best understock for Japanese cherries was that of the Sargent cherry, *Prunus Sargenti*, formerly called *Prunus serrulata sachalinensis*.

Mr. William H. Judd, Propagator at the Arnold Arboretum, after long experience with these plants, now feels that the use of *Prunus avium* as an understock is perfectly satisfactory. This understock "works" slightly better than that of the Sargent cherry and is certainly much more easily obtained. It is widely used for this purpose by many nurserymen. Particular forms of *Prunus subhirtella* can be grafted on seedlings of this species. *Prunus yedoensis* may be grown from cuttings or grafted on *P. avium* stock. All double-flowered varieties can be grafted on *P. avium* stock. There are certain species which can be readily grown from seed, and would include *P. Sargenti*, *P. incisa*, *P. nipponica*, and often even the hybrid, *P. yedoensis* although in this species the plants do not always come true from seed. The Arboretum wishes to modify certain statements which have been made in the past in this Bulletin regarding understock for Japanese cherries and emphatically states that *P. avium* as an understock has certainly proved as good if not better than *P. Sargenti*.

Prunus Sargenti. Introduced about 1890 from seeds sent to the Arboretum by William S. Bigelow, this fast growing tree has proved the most hardy of all the Japanese cherries. It is the tallest, being a fair-sized tree, and is the only one of all the Japanese cherries that has any autumn color. This is a good deep red. The flowers are deep pink and single. It is one of the first Japanese cherries to bloom, usually opening before or at about the same time as the leaves appear. Because of its size, its hardiness, and its attractiveness in both spring and fall, this cherry is proving a valuable ornamental and is



PLATE III

Prunus Sargentii (formerly *P. serrulata sachalinensis*)

This is the largest and hardiest of all the Japanese cherries. It may be either upright and pyramidal in form (as in foreground) or considerably more rounded (see other tree at rear of bench).

deserving of much wider use.

Prunus yedoensis. The Yoshino cherry is another one of the single-flowered forms and makes up the greatest part of the display at Washington, since almost half of the original gift from Tokyo was of this variety. Professor Sargent wrote of this tree in 1922 that it was one of the favorites in Japan and before the earthquake in that year there were over 250,000 trees in Tokyo alone. The Sargent cherry is often upright in habit, but the Yoshino is more spreading. It has pale pink flowers which sometimes are almost white and can be combined with the Sargent cherry for general landscape effect, for the flowers of both open at approximately the same time.

Prunus subhirtella. The Higan cherry is perhaps the most floriferous of all. Its single flowers are borne in the greatest profusion, and it is not unusual to find the branches literally covered by the blossoms. There is wide variation in the shapes of individual trees when grown from seed, but as a rule they are small and of very bushy habit with pale pink blossoms. All cherries, of course, are used most effectively in front of an evergreen background of pine or hemlock wherever such planting is possible.

Perhaps the most common cherry planted now is the drooping form of the Higan cherry, *Prunus subhirtella pendula*. Another outstanding form is *Prunus subhirtella autumnalis*, which often has a second bloom in the fall though at that season it is not particularly outstanding. Last spring a large tree of this variety was more attractive than any of the other cherries in the Arboretum. Its light pink, semi-double flowers are most outstanding. If the crop of flowers in the spring is unusually large, then the number of flowers in the fall will be very small. This tree is another good type and should be used a great deal more in combination with the early blooming single-flowered types.

FIELD CLASS AT ARBORETUM DURING MAY

A Field Class will be conducted Saturday mornings during May to assist those who wish to gain a more intimate knowledge of the flowering trees and shrubs growing in the Arnold Arboretum. The class will meet from 10:00 a.m. to noon, is open to anyone who is interested, and will meet at the Forest Hills Entrance of the Arnold Arboretum for the first time on Saturday, May 1.

Registration for the course is one dollar, payable in advance by mail.

DONALD WYMAN

ARNOLD ARBORETUM
HARVARD UNIVERSITY



BULLETIN
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NUMBER 3

THE IDENTIFICATION OF PLANT MATERIAL
AT THE ARNOLD ARBORETUM

THERE are many ways in which the Arnold Arboretum furnishes the public with information concerning trees and shrubs. One of these is the identification of plant material sent through the mail. Most of the work of identifying plants is done in the herbarium, and it may be interesting and helpful to give some account of how the work is handled.

When a specimen is received at the Arboretum, it is examined by some member of the staff, who may be able to identify it at sight. Some plants are so distinct and easily recognizable that it may be possible to name them from a single typical leaf or fruit, but often the problem is not so simple. If the plant is not readily recognized, the investigator tries to limit it to certain plant families through such characters as are shown by the specimen, and then proceeds to follow up clues that may lead to its full identification. This is done by comparing it with mounted specimens in the herbarium, or, if possible, with living plants, and by consulting descriptions and illustrations in the literature dealing with the group to which it is thought to belong. This may involve much library and herbarium search, and hours may be spent in solving a particularly difficult problem. Sometimes the material received is so inadequate that the investigator must send for a more typical specimen. However, because of an unwillingness to disappoint the inquirer and because a difficult problem offers something of a challenge, every effort is made and every means is exhausted before such a course is taken. In cases where some doubt may remain after a careful study of the material, the investigator often consults with other members of the staff, especially if the plant belongs to a group with which one of his colleagues is especially familiar.

Plants are extremely variable, there often being a wide range of diversity in various characters even within a single species. Some groups of plants are much more variable than others. For example, in the roses, apples, plums, hawthorns, cherries and others, there is such great variability that authorities differ widely as to their classification. Some recognize numerous species based on slight varia-

tions while others place these slightly varying forms under a single name. The leaves of a species may differ greatly in shape and size, not only in different plants, but even on a single plant; while sometimes flowers, fruits and other parts are equally variable. Again, the leaves of seedlings, young plants, or those from vigorous shoots are very different from those of the mature plant or of typical flowering branches. Some of the divergent forms seem to be due to ecological conditions, such as the character of the soil, or the amount of light, moisture and shade received. Some of these aberrant forms can be accounted for only as sports or abnormalities, some as hybrids between related species, and in other cases they can only be regarded as individual differences, which are common to all living things. Consequently, when branches are selected for identification they should be taken from a normal plant. They should be fully matured in growth, but not have reached maturity too fast, due to excessive vigor, or too slowly, due to poor growth conditions, insect or disease troubles. If normally matured typical branches are selected, the inquirer will go a long way in assisting the Arboretum staff to correctly identify specimens.

A vast amount of literature has been written about plants, and this is being increased each year by students of various groups in all parts of the world. That the subject of plant classification is one regarding which the last word has not been said is shown by the fact that for the higher groups of plants alone about 6500 new binomials are published each year, of which approximately 4750 represent species supposed by their sponsors to represent previously unnamed and undescribed ones. Furthermore, many groups are subject to constant study and revision. Good manuals, covering the floras of most parts of the United States have been published and many other reference books about both native and cultivated plants are available. Some of these books are fully illustrated and contain keys and descriptions that make them valuable and almost indispensable to serious students of plant life. However, the information they contain is limited, because of the great number of species considered, and it is impossible to include in them more than brief descriptions, these usually limited to the typical forms. In any event, when a specimen comes to the Arboretum for identification, the investigator is familiar with these various sources of information, and thanks to the excellent library facilities available, he can turn to the desired references immediately.

Suggestions for shipping

In sending material for identification, a few simple rules, if observed, may save disappointment to the inquirer as well as much time and trouble to the Arboretum staff. For the identification of trees or shrubs a small branch should be sent which bears flowers or fruit, as well as typical leaves. The specimen may either be pressed and mailed dry between cardboards, or if the material is not too fragile or the distance too great, it may be sent fresh. Fresh specimens may be placed between paper and cardboards or packed in waxed or slightly dampened paper and either mailed in a carton or protected by heavy wrapping paper. When more than one specimen is sent, each should have a number attached to it, and a list should be sent with corresponding numbers, giving as much information as pos-

sible about the plant. In doing this, the same numbers should be given to the plants from which the specimens were taken. Large fruits, not attached to the branches, may be wrapped separately and should also bear the same number as the leaf specimen to which they belong. It should be indicated whether the plant is a tree, shrub or vine, the approximate height and general habit or shape, also whether it was found wild or in cultivation; if from cultivated plants, the source of the plant or seed should be indicated if known. It is also helpful to give the popular or local name, if known, and to state the color of the flowers which may be too much faded when they arrive for this to be determined.

In the case of crab apples and similar plants represented in gardens by numerous hybrid forms, both flowers and fruits are often necessary for identification; herbarium specimens of both stages from the same plant, or herbarium specimens of one and fresh specimens of the other should be sent at the same time. With thousands of specimens sent each year for identification, it is manifestly impossible to preserve the specimens sent and keep track of corresponding specimens received at different seasons of the year.

However, it is not always possible to send samples of flower and fruit of deciduous plants. In some cases, particularly with the general run of nursery stock, accurate identification can be made without these aides, but in most cases they are necessary. For instance, it is comparatively easy to identify a normal twig of a crab apple, but with a few exceptions, almost impossible to tell the exact variety without the flowers or fruit or both. The inquirer should keep these points in mind and not expect the impossible where flowers and fruits are not sent.

Many of the evergreens however, cannot be readily distinguished without cones, if at all, and thus cones should always be sent if possible. Some cultivated forms and varieties are distinguished solely by the shape or habit of the plant, and can thus be recognized only if information about these characters be given. In some cases it is necessary to have mature acorns or nuts in order to distinguish between different species or varieties of hickories and oaks, and both flowers and fruit may be necessary before some species of plums, apples and haws can be determined.

The inquirer sending a plant for identification naturally desires to learn a definite name for it, and in the great majority of cases, it is possible to give this information if the material received is at all adequate or typical. Sometimes, because of meager, incomplete, or poorly preserved specimens, identification is impossible. In some cases, even though the material is ample, only approximate identification is possible, because the specimen may not be typical and may differ in some character from the species to which it seems most closely related. This anyone who has had considerable experience in studying plants readily understands but to the inexperienced, it is sometimes difficult to explain why definite identification of the species, variety or form is not always possible.

The material received for identification at the Arboretum ranges from a single specimen, sometimes unfortunately consisting only of a detached leaf or fruit, to collections numbering hundreds of specimens. Occasionally seeds, sterile twigs, resins, gums, and specimens of wood are submitted for identification. Many speci-

mens of herbaceous plants are sent to the Arboretum, although our living and reference collections are limited to woody material. Occasionally even mosses, lichens, and fungi are sent to us from friends who seem to have too great confidence in our stock of information. These may be referred to other departments of the University, such as the Gray Herbarium in case of herbaceous species, and to the Farlow Herbarium for cryptogamic plants.

The correspondents who call upon the Arboretum for information range from professors of botany in leading educational and scientific institutions to persons with little or no knowledge of plants. The Arboretum is also often called upon for advice by commercial concerns and by importers of various commodities, utilized in industry. Occasionally, we have been asked to furnish evidence to be used in litigation, or even to settle a wager. During the height of the cross-word puzzle craze, numerous inquiries were received, most of them by telephone, regarding the name of some tree or other plant with vaguely described characters but containing a definite number of letters. After a few good-natured efforts to comply with these requests it was decided that this was not really part of our mission in the world.

There are no fixed formulas for identifying plants, nor does the scientist possess any occult powers for distinguishing them. All that the investigator can do is to examine the material available, noting the characters shown, and try to place it in its proper relationship in view of what he knows about plant classification and the characteristics that distinguish plant families, genera and species. Only when good material is supplied can the determination be made with facility and certainty.

The botanist is not infallible and he is not dealing with an exact science. If he is honest, he will sometimes have to express a doubt, or admit that he does not know, and at times he may make mistakes. As an illustration of the difficulty found in some groups of plants, a botanist in one of the western states, in studying the plants of his region, found a number of specimens of wild roses that were difficult to classify, and some of these were sent to other botanists for study. In one case he reports sending identical specimens from the same plant to four of the leading botanical institutions of America, and of receiving in reply four different opinions as to the identity of the plant. Being himself a botanist and realizing some of the difficulties involved, he did not, as a result, completely lose confidence in the institutions nor in the value of the opinions of the man connected with them; at least he is still sending puzzling specimens to the Arboretum for determination.

From the appreciative letters received from correspondents who have called upon us for help, we believe that the service the Arboretum is rendering in plant identification is a useful one. We wish to make the service as efficient as possible and to answer all inquiries as promptly and as fully as we can. It is hoped that this explanation of the methods followed and of the limitations of the service may be mutually advantageous to our correspondents and to the Arboretum.

ERNEST J. PALMER

ARNOLD ARBORETUM
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TWO MONTHS OF AZALEA BLOOM

AZALEAS form a most colorful display of bloom in the springtime, and if care is taken in selecting certain species it is possible to obtain a flowering sequence for a period of over two months. Many azaleas commonly grown in the south are not hardy in the northeastern United States, but all are valued for their bright flowers and some for their fragrance. The foliage of some deciduous azaleas turns a brilliant red in the fall, and such forms certainly warrant more extensive use. The more plants of twofold interest that we can use in our gardens, the longer our gardens will be enjoyed.

What are the differences between rhododendrons and azaleas?

Now that azaleas are classed in the genus *Rhododendron*, this forms a perplexing problem to many, but is well clarified by a recent statement made by Professor Alfred Rehder: "There are no clear cut characters between rhododendrons and azaleas; they can only be separated by a combination of characters. Rhododendrons are all evergreen except *R. mucronulatum* and *R. dauricum* but there is an evergreen variety of the latter: they have mostly ten or sometimes more stamens, and the leaves are often scaly or lepidote; azaleas are mostly deciduous; they have mostly five stamens, the leaves are never dotted with scales and are often strigose. The two deciduous rhododendrons are distinguished from all azaleas by the leaves being dotted beneath with minute scales and also from most of them by the ten stamens."

As with rhododendrons, all azaleas need acid soil. This is not the only soil requirement, for it is usually best to keep their roots cool and moist all the time. This is best done by applying a good mulch, such as well-rotted oak leaves, pine needles, or acid peat moss.

Although there are a large number of excellent hybrid azaleas a-

vailable in the trade today, it is the object in this bulletin to discuss briefly only certain species which are known to bloom in sequence, so that by selecting plants from this list it may be possible to have azalea flowers in the garden for eight or ten weeks.

ORDER OF BLOOM

Late April

Rhododendron mucronulatum	Korean Rhododendron
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Early May

Rhododendron obtusum amoenum	Amoena Azalea
Rhododendron obtusum arnoldianum	
Rhododendron obtusum "Hinodegiri"	Hinodegiri Azalea
Rhododendron mucronatum	Snow Azalea

Mid May

Rhododendron canadense	Rhodora
Rhododendron obtusum Kaempferi	Torch Azalea
Rhododendron yedoense poukhanense	Korean Azalea
Rhododendron Schlippenbachii	Royal Azalea
Rhododendron Vaseyi	Pinkshell Azalea

Late May

Rhododendron atlanticum	Coast Azalea
Rhododendron japonicum	Japanese Azalea
Rhododendron nudiflorum	Pinxterbloom
Rhododendron roseum	Downy Pinxterbloom

Early June

Rhododendron calendulaceum	Flame Azalea
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Late June

Rhododendron arborescens	Sweet Azalea
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Early June

Rhododendron viscosum	Swamp Azalea
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Rhododendron mucronulatum (sometimes incorrectly called *Azalea mucronulata*): This was originally introduced into America by the Arnold Arboretum in 1882 and blooms before any of the azaleas. It is the only true rhododendron discussed in this Bulletin and is one of the two deciduous rhododendrons. The flowers are large and rosy purple. If the weather remains cool, it may hold its beautiful flowers for about two weeks. Sometimes late frosts kill the flowers after they have opened, but if it is planted in the shade and protected from the morning sun the chances are increased for its remaining in good condition for some time. Most of the early blooming shrubs have yellow flowers in the early spring, but here is one with a rosy purple color

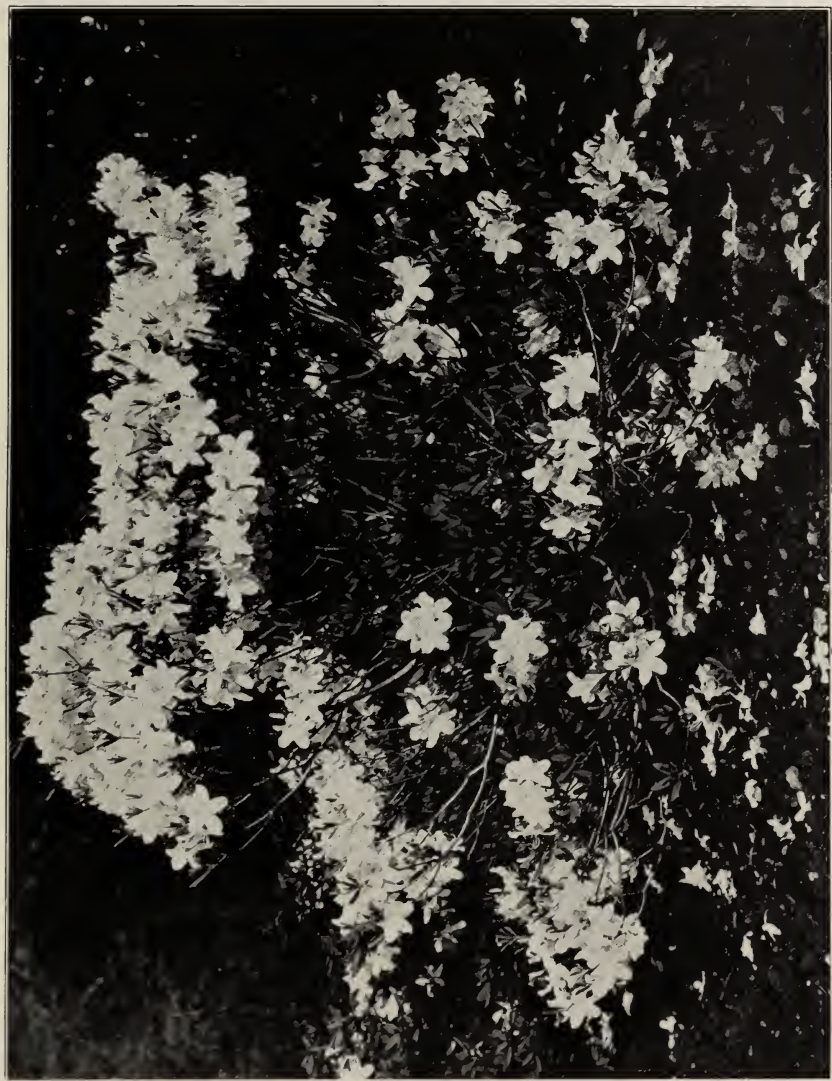


PLATE IV

Pink-flowered *Rhododendron Schlippenbachii*

which makes it very conspicuous.

Rhododendron canadense (*Rhodora canadensis*): The *Rhodora* grows all over New England and southeastern Canada where it covers large areas of many acres. It has small flowers of magenta-rose or lilac to nearly white in color. It likes moist swampy areas where it is perfectly at home. It grows about 1 to 3 feet tall and is perhaps the least ornamental of all North American azaleas although it is admired by many and used considerably in naturalistic plantings.

Rhododendron mucronatum (*Azalea mucronata*, *A. ledifolia alba*, *A. indica alba*): Unfortunately, this lovely white flowering azalea, although perfectly hardy from Long Island southward, is not completely hardy in New England gardens. Still it can be grown in shaded and protected situations. There are excellent plants doing well in gardens on Cape Cod. This lovely plant, so highly valued for its white flowers, has been in this country for almost one hundred years. It is one of the best azaleas for pure white flowers, it roots readily from cuttings, and forms a dense flat-topped mass of foliage that faces to the ground on all sides. Where it can be well grown, it is an excellent plant to use in combination with such bright colored species as *R. obtusum Kaempferi*, for although it blooms slightly earlier, the flowers remain on the plant long enough to make a striking color combination with the later blooming torch azalea.

Rhododendron obtusum: Neither *R. obtusum amoenum* (*Azalea amoena*) nor *R. obtusum* “*Hinodegiri*” (*A. Hinodegiri*) are completely hardy in Boston. The former is probably hardier than any other evergreen azalea, but its flowers are a very poor magenta color that is extremely hard to use in combination with any other color. On the other hand, *R. obtusum* “*Hinodegiri*” has decidedly better flowers and foliage, but it is not quite as hardy. The foliage of both of these plants is superior to that of *R. mucronatum*. In some places *R. obtusum amoenum* is used as a clipped hedge, because of its very small leaves and also because it stands clipping very well. *Rhododendron obtusum arnoldianum* (var. *amoenum* × var. *Kaempferi*) is similar to var. *amoenum*, except that it grows taller and is hardier, being hardy in the Arboretum, and the flowers are a deep rosy mauve to red. It originated in the Arboretum as a seedling in 1910, and can be substituted for var. *amoenum* where this is not hardy. *Rhododendron obtusum Kaempferi*, the torch azalea, is the common mountain azalea of Japan. Although it had been known for a very long time, it first appeared in the United States when Professor Sargent brought seeds to the Arnold Arboretum in 1892. Since that time it has grown splendidly and has proved to be the best bright



PLATE V

Rhododendron yedoense poukhanense

Raised in the Arnold Arboretum from seed collected on Poukhan, Korea, in 1905 by J. G. Jack. (*Drawing by Blanche Ames Ames*)

red azalea for northern gardens. The Arnold Arboretum now has hundreds of these plants on its hillsides, and when they are in bloom they make a better display than any other azalea. In places the woods look almost as if they were afire, the color is so vivid. Because the flowers may be injured by the hot sun, it is advisable to plant them in shaded places, and they do well even in complete shade. In the Arboretum some of the plants are considerably over 5 feet tall, and they may eventually attain a height of 10 to 12 feet, with a correspondingly broad spread.

In Massachusetts the plants are partly deciduous, but further south the leaves of *R. obtusum* varieties (except var. *Kaempferi* which is wholly deciduous) are retained throughout the winter. The flowers of var. *Kaempferi* range in color from salmon to a brick red. When the plants are massed together, as is often best in order to afford some protection to the roots, they make a dense mass of foliage and flowers and form one of the best displays of Japanese plants growing in the Arboretum.

Rhododendron yedoense poukhanense (*A. poukhanense*): Originally named by a French botanist from Mt. Poukhan in Korea, where the plant was discovered for the first time by a French missionary, this plant was introduced into this country by Professor J. G. Jack of the Arnold Arboretum in 1905. The flowers are a pale lilac-purple and are usually borne in great profusion. The plant itself rarely grows taller than about 3 feet and is thus well suited for rock gardens and small borders. The branches grow close to the ground making a dense mass. In using it in combination with other flowering plants, its color should always be kept in mind for this proves rather difficult to combine well with red. There is a double-flowered variety available called "Yodogawa," but it is more tender.

Rhododendron Schlippenbachii (*A. Schlippenbachii*): This is another Korean plant much used in that country, introduced by the Arnold Arboretum from seed sent by Professor Jack. The flowers are very large, sometimes as much as 3 inches in diameter, and a pale to rosy pink. Apparently perfectly hardy under New England conditions, this plant may grow to be 15 feet tall. One of its valued characteristics is the fact that in the fall the leaves turn from yellow to orange crimson, thus enabling landscape gardeners to utilize it for autumn as well as spring color.

Rhododendron Vaseyi (*A. Vaseyi*): This is the second of the native American azaleas to bloom in the spring. It is found in a few valleys of the southern Appalachian mountains, chiefly in South Carolina

where it grows to be 15 feet tall. The flowers appear before the leaves and are a good pink color. It is perfectly hardy in Boston and is highly valued for its delicate flowers, which are very conspicuous because they appear before the leaves.

Rhododendron japonicum (*A. japonica*): The large orange-red flowers of the Japanese azalea are particularly outstanding, but unfortunately they have a most disagreeable odor. The plant is valued for its large flowers and its hardiness. Because it is perfectly hardy under New England conditions, it is used considerably in breeding work. During late May, there are a large number of multi-colored azaleas that bloom in great profusion, and many of these are hybrids of this Japanese azalea. Of these hybrids there are two general groups:

1. *Rhododendron gandavense*: The Ghent azaleas are very popular and many interesting forms are available. These result from crosses between the tender, fragrant, yellow-flowered *R. luteum* (*A. pontica*) the American *R. calendulaceum*, and *R. nudiflorum*. The colors in these hybrids are all shades and combinations of those of the parent plants.

2. *Rhododendron Kosterianum*: The "Mollis" hybrids are the result of a cross between *R. molle*, which is tender here in the north, and *R. japonicum*. Mr. T. D. Hatfield's original hybrid named "Miss Louisa Hunnewell" is an outstanding example of this group.

Rhododendron nudiflorum (*A. nudiflorum*): All the azaleas blooming after June first are natives of this country. The common pinxter-bloom is a familiar sight everywhere, for it is native over wide areas of the eastern United States.

Rhododendron roseum (*A. rosea*, *A. nudiflora rosea*): Another New England plant, this is probably the best of the azaleas native to this general region. Its flowers are a deep rosy pink, and most fragrant.

Rhododendron atlanticum (*Azalea atlantica*): This little azalea is native on the Coastal Plain from southern Pennsylvania to South Carolina. It seldom gets over 18 inches tall and can be considered the smallest of all the azaleas here mentioned. Its flowers normally are white (there are pink forms) fragrant and about the size of the flowers of *Rhododendron nudiflorum*. It is considered as hardy as *R. obtusum Kaempferi*, does well in the Arboretum and is an excellent little plant to use, particularly in small scale plantings. It does equally well in both sun and shade, and is good for filling in around the bases of taller growing azaleas when this is necessary.

Rhododendron calendulaceum (*A. calendulacea*): The flowers of the flame azalea are usually a brilliant orange red, but lack the fragrance of the two preceding species. It occurs in the mountains from Penn-

sylvania south to Georgia, and is very abundant on the lower slopes of the high mountains of North Carolina and Tennessee. It is the most showy of the American azaleas which have been established in the Arnold Arboretum. It is perfectly hardy and superior to most of the hybrids derived from it. One of its best features is the fact that its flowers remain in good condition for a considerably longer period than do those of the Asiatic azaleas, for they are not injured by excessive heat.

Rhododendron arborescens (*A. arborescens*): Since the flowers of this azalea do not appear until after the leaves are fully grown, it is not as conspicuous as some of the others, but it is very fragrant. The white or slightly pink flowers are of interest because of their fragrance and also because of the long red stamens. At high elevations it only grows a few feet tall, while in valleys in the mountainous regions where it is at home it may grow to be 18 feet tall. It is another native of the Appalachian mountains.

Rhododendron viscosum (*A. viscosa*): This is a common plant in swampy regions in the northeastern United States and is valued because it is the last of all the azaleas to bloom. Its flowers are usually pure white and most fragrant. Strangely enough, in spite of its natural habitat, it does not require swampy conditions, as it will thrive in almost any fertile acid soil.

Horticultural Society Field Day

The Massachusetts Horticultural Society will hold a Field Day at the Arnold Arboretum on Thursday, May 20 at 2 P.M. to discuss and inspect the lilacs. If rainy the meeting will be postponed until the next day. The group will meet promptly at the Administration Building of the Arboretum. After a short discussion a careful inspection of the lilac collection will be made.

The lilacs will be in full bloom the week end of May 22. This large collection at the Arboretum is unusually well budded this year and the display of flowers should be most outstanding during the current week.

DONALD WYMAN

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THE CHINESE COLLECTION

ONE of the most striking portions of the Arnold Arboretum during May and early June is the varied collection of shrubs and trees planted on a rounded knoll just southeast of the summit of Bussey Hill. Gently curving grass paths encircle the crown of this knoll, with branches leading off down the slopes in different directions.

Two of these paths lead off from Bussey Hill Road opposite the banked plantation of forsythia which has produced such a wealth of color this spring. At the points from which they take off the paths are margined with tall vacciniums, barberries and calicarpas. One goes only a short distance before he is confronted with a splash of brilliant yellow in the plantings of cytiscus and genista which lie between the paths. To the right is the nearly pure white *Rhododendron Schlippenbachii* which has the largest flowers of any of the azaleas in the collection. From here on there is a profusion of color and form. A mound of lilac-purple blossoms nearly conceals a massed planting of the Korean azalea (*Rhododendron yedoense* var. *poukhanense*). Under the old pines are the early-flowering *Rhododendron mucronulatum*, various forms of *Enkianthus* with their delicate pendulous blossoms, and the brilliant *Rhododendron obtusum* var. *Kaempferi*. Farther down the slope to the southward are beds of the hybrid azaleas in whose flowers a variety of salmon-pink tints play havoc with our usual concepts of color in this group. The dove-tree (*Davidia involucrata*) is represented in several places along the upper paths. It was killed back to the ground during the recent hard winters, but now shows vigorous sprouts six to eight feet high. *Fothergilla*, *Leucothoë*, *Stewartia*, and many forms of *Cotoneaster* are arranged in the beds above the pines, as well as the exotic maples (*Acer Tschonoskii*, *A. griseum*) and *Euptelea*.

In large beds around the crown of the hill, inside the paths, are barberries, honeysuckles, cotoneasters, hydrangeas, *Kerria* and *Acau-*

thopanax. Near the point where the largest of the paths returns to Bussey Hill Road is a large plant of *Exochorda*, the pearl bush. The top of the knoll itself has an open plantation of flowering cherries, crab apples, barberries, and honeysuckles.

On the south side of the knoll, rising from the midst of an extensive planting of azaleas, are some ancient white oaks. They are much the largest and oldest trees in the Arboretum. In 1931 the lightning killed one of these veterans and it was immediately cut down, showing a trunk which had resisted disease so successfully that it was solid to the center. It proved to be about 265 years old, so that its life span covered most of the period since the first hardy settlers took up land in the Town of Roxbury. It was a young spindling shoot in the 1670's and during the first 90 years of its life it attained a diameter of only 6 inches. This can indicate that it grew until about 1750 or '60 in a rather dense woodland of trees so large that they kept it in shade. At about this stage in its life, however, the surrounding remnant of the primeval forest in which it stood was nearly all cut down. The result was that, relieved of competition with its older neighbors and exposed to full sunlight, it acquired a new lease on life. From that time on it grew rapidly, putting on thick rings of wood each year.

It is intriguing to reconstruct the scenes which have passed upon this knoll during the lifetime of the old oaks. Several generations of the children of the Weld families that lived on the property must have played among the great columnar trunks of that small patch of primeval woods which persisted for at least half a century in the otherwise cleared pastures and orchards of the district. Hepaticas, columbines and asters must have made a garden of the shaded aisles. In Revolutionary times when firewood was scarce in Roxbury, the stunted remnants of the old wood were too small or too inaccessible to be attractive. Or perhaps they were purposely preserved by some Weld descendant to keep alive childhood memories.

In the first decade of the 19th century Mr. Benjamin Bussey, a well-to-do Boston merchant, realized the beauty of the site and purchased the farm containing it for a country home to which he could retire in his declining years. He built his mansion on the easterly side of what we now call Bussey Hill, and a summerhouse at the top of the slope. A double row of white pines was planted in rectangular arrangement around the crown of the hill, and long rows of lilac bushes margined the paths which led up to the summerhouse. Several of the pines are still standing: and though somewhat broken in appearance and bent to the eastward by the winds, they contribute much to the beauty of the modern plantations. The rows of lilacs, large parts of which also remain after at least 125 years, have grown together so that the old paths are scarcely visible. To the westward were views of pasture and orchard, in fields separated by the characteristic stone



PLATE VI

Part of the Chinese Collection on the top of Bussey Hill
in the Arnold Arboretum

walls which lend charm and order to so much of the New England landscape. Northeastward were Jamaica Plain and Roxbury, and on clear days the Bay was visible. Southeastward one could look across the valley of Stony Brook to Milton and the Blue Hills. From the time of the changes wrought by Mr. Bussey the top of the hill has remained a garden spot. At his death about the middle of the last century, he left it to Harvard College as part of a foundation for a school of agriculture and horticulture. Subsequently Frederick Law Olmstead, pioneer in American landscape architecture, planning the Arnold Arboretum with Professor Sargent, clearly recognized its attractiveness and potentialities. Bussey Hill Road, made to encircle the hill and end in a broad plaza on the summit, gave easy access to the whole area and ensured its significance as a focal point in future developments.

The plantings as we know them now did not take form until about 25 years ago when the collection of the late E. H. Wilson began to appear at the Arboretum. Our rounded knoll was selected as a suitable place for a special exhibit of floral wonders introduced by this gifted gentleman, and the whole area became known as "the Chinese collection." An old photograph in the library of the Arboretum shows that early in the 1900's the knoll was a grassy meadow from which hay was cut in summer. Its soil is gravelly and poor, and the long struggle to make it suitable for planting can only be visualized from Professor Sargent's cryptic records in his annual reports and from the recollections of men still at the Arboretum. At one time, for instance, masses of peat cut from the low ground of the South Street tract were strewn over the beds to increase their fertility.

The old oaks have seen the whole gamut of change. They served as part of the background for the long years of toil and struggle endured by the colonial farmers who built their successful communities in the New World. Forces which began to be felt through the ambition and imagination of Mr. Bussey finally brought the land into contact with a great educational enterprise so that it contributed its small part to the vast influence upon American applied biology which the Bussey Institution exerted. But the later scenes are the strangest. Here are exotic plants brought from the other side of the world to be tested for beauty and adaptability before they can be used to grace American gardens: azaleas with giant, pure white flowers entirely unknown in America; other azaleas with almost every conceivable combination of red, orange, white and purple; the curious dove-tree with flowers like great white wings; and impossible maples with copper-colored bark that peels off in thin sheets like that of the sycamore. Such wonders were certainly beyond the wildest dreams of those children of the Welds' who played here. The only continuity is in the inherent charm of the place and in the lives of the ancient oaks.

HUGH M. RAUP

ARNOLD ARBORETUM HARVARD UNIVERSITY



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A TRIP THROUGH THE ARBORETUM DURING LILAC TIME

THOUSANDS of people have had the opportunity of visiting the Arboretum during the past ten days, and they have been fortunate for the Arboretum is now at its best. This Bulletin is written in order to aid our many visitors in remembering a few of the many things they have seen in bloom. Perhaps too, those who have been less fortunate and were unable to visit the plantations during this period, may derive some enjoyment from reading this enumeration of the plants of outstanding beauty which have been admired by so many.

Most of the trees and shrubs at the Arboretum are looking better this year than they have for several years past, merely because the mild weather has not injured any of the flower buds. We have been unable to find any evidence of winter injury due to low temperatures. Elsewhere in eastern Massachusetts, particularly where rock garden plants and perennials are grown, there has been considerable injury owing to lack of snow during last winter from the soil heaving and exposing the roots of the plants, but fortunately this has not been true of the trees and shrubs. Many of the azaleas, the flowering dogwood, and the lilacs have really been exceptionally beautiful during the past ten days because the flower buds have been untouched by the winter cold and all have fully opened.

Starting the trip through the Arboretum from the Jamaica Plain gate, we first notice the peculiar green flowers of the native *Magnolia acuminata* beginning to bloom. The flowers of the Asiatic magnolias have long since passed. Continuing on the road from the Administration Building we pass the lindens and an excellent bed of *Rhododendron roseum* which has been in full flower for an entire week. A little farther on, near the horse chestnuts, is a planting of the daintily colored pinkshell azalea, *Rhododendron Vaseyi*, which adds a bright spot to any landscape scene. Opposite this are the many forms of the Japanese maples coming out into full leaf, and the brilliant red of their foliage makes a beautiful contrast with the white flowering dogwoods close-by. In the woods are several hundred torch azaleas, *Rhododendron obtusum Kaempferi*, which have been in full bloom for over a week, and because of the excellent shade of the surrounding oaks, their flowers

keep their color for a considerably longer period than do those of azaleas planted out in the full sun.

Leaving the road for a moment, we stroll through these azaleas to a knoll in the woods overlooking the shrub collection. Approximately a thousand different shrubs are growing here, and with a hasty glance from our vantage point we notice that there are not many plants in bloom. At the extreme left there is a bright spot of white close to the ground (*Iberis Tenoreana*), and nearby another bright spot of yellow (*Alyssum gemonense*), blooming at the same time, while *Iberis sempervirens* will not bloom for another week. Looking farther, we see the white of some spiraeas in bloom, and at the end of the collection the tall pearlbrushes in full bloom. In front of us is a long row of vari-colored varieties of the Japanese quince, but as these have been in bloom for over two weeks they have now nearly lost their brilliance.

Beyond the shrub collection, along the road on the farther side we see the last of *Malus spectabilis*, one of the double-flowering crab apples, and the first of the common pink Bechtel's crab coming into bloom. When the wind changes for a few minutes, we can immediately identify the fragrance of the bush honeysuckles which are now in full bloom nearby.

Continuing from the woods interplanted with torch azaleas, we glance backward through the shrubbery overhanging a pond on the left to see an excellent planting of *Rhododendron Vaseyi* in full bloom, the dainty shell-pink color of the flowers reflected in the still water at their feet. Continuing between the ponds we turn to the right and approach the lilac collection.

What a sight! The bank is one mass of color. In this collection, one of the two best in the world, are over 400 different kinds of lilacs including over 300 different varieties of *Syringa vulgaris* alone. A good growing season followed by a mild winter has resulted in a profuseness of bloom unequaled for several years past. One of the first plants to draw our attention is the dark purple variety of *Syringa vulgaris* named "Ludwig Spaeth." We admire it, walk under its branches, and look up the lilac walk, bordered on both sides with lilacs ten feet tall and covered with blossoms. We notice at least two lilacs (*Syringa amurensis*, the Japanese tree lilac, and *S. villosa*, the late lilac) that are not in bloom, for these come later, one in July and one in June. Continuing up the walk among the lilacs, we see the most fragrant of all, *S. pubescens*, and can easily recognize its value even though its flowers are not conspicuously colored.

On the left of the walk is the interesting small Persian lilac and its several varieties. Nearby is *S. chinensis*, the first known hybrid, resulting from a cross between *S. persica* and *S. vulgaris*. One of its varieties, *S. chinensis Saugeana*, is particularly valued for its dark reddish flowers. Both the Persian and the Chinese lilacs are valued for their profuse, graceful, nodding sprays of flower clusters which make them among the best for cut flower purposes.

Near the end of the row of lilacs, placed between the walk and the road, are two plants outstanding for their deep reddish-purple flowers, namely "Congo" and "Negro." Incidentally, it was this row of lilacs which was cut to the ground ten years ago in an effort to reduce the size of the plants and so force them to

grow into better specimens which would be appreciated more. A critical survey of these same plants today will show that this severe treatment has resulted in plants which are now in excellent condition. Many people who knew this row of plants the year it was cut to the ground have remarked this season that although such rough treatment is not always warranted it has certainly proved worth while in this case.

On the hill at the extreme end of the lilac collection are the younger lilacs recently added. One of these shows promise of becoming the darkest of all the dark lilacs. This is named "Mrs. W. E. Marshall" and is of very recent origin. Many of these lilacs are so intriguing that it is necessary to walk over the grassy path at the top of the collection and see close at hand some of the plants that we could only glimpse from below. One of these is a stunning single white variety named "Vestale" which is unusually well-flowered this year. Another variety close by is the double-flowered "Edith Cavell" also outstanding for its white flowers.

Of the pink varieties, "Macrostachya," "Lucie Baltet," and "Clara Cochet" can all be observed in order, one after the other, growing along this path. Farther along on the right we must stop to admire the best of the pale blue lilacs, "President Lincoln," the flowers of which are a wedgewood blue. It is most difficult among so many fine specimens to decide definitely on a few "best." Professor Sargent use to say that the "best" lilacs were always those that happened to have the best flowers that year, and perhaps this should be our conclusion.

Climbing up toward the top of Bussey Hill we pass through an old lilac hedge which is easily one hundred and twenty-five years old. These bushes are seldom pruned and sprayed, and are living examples of what lilacs will do under adverse conditions. They are now about ten feet tall (having been cut to the ground several years ago) and almost twice as broad, but even with the lack of care they do have many blooms each year. At the top of Bussey Hill in the Chinese Collection we find many things in full bloom. Our first impression is one of brilliant yellow color coming from the brooms which are at their best. These belong to the genera *Cytisus* and *Genista*. One plant stands out particularly among these because of its brilliant mass of profuse lemon-yellow flowers. This is *Cytisus praecox*, and those who have admired it will be glad to know that it is available from certain nurseries.

To the right of this walk, across from the brooms, we see the last of the royal azalea, which is one of the first in the collection on the hill to bloom. Over the brow of the hill we notice many of the torch azaleas dotting the hillside here and there. Walking on toward the century old pine trees, acting as guardian sentinels for the entire collection we pass a bed of two beautiful azaleas, *Rhododendron roseum* and *Rhododendron nudiflorum*. These came into full bloom on lilac Sunday, and their sweet fragrance fills the air. Beyond these is the Poukhan azalea, its lavender-purple flowers fading rapidly for it has been at its best for almost two weeks. However, one or two of the plants which are late to bloom indicate to us what the entire planting must have looked like when it was at its best.

We notice that the dove tree, so interesting because of its history, has again disappointed plant lovers and has not bloomed. This tree was killed to the ground during the cold winter of 1933-34 and has not bloomed since. Each year we look

forward to seeing its blossoms, but usually we are disappointed. Under the pine trees are the best plants of the torch azalea in the entire Arboretum. Here some are at least six to eight feet tall, literally one solid mass of fiery red blossoms. It is easy to notice the injury from the hot sun for some of the blossoms are badly faded and burned at the tip of the petals, but when they are growing in the full shade they keep their color very well for some time.

Continuing down the hill among the azaleas, we come to an excellent group of "Ghent" and "Mollis" hybrids on the left, many of which are just beginning to show their excellent, highly colored blossoms. A number of these are perfectly hardy under Boston conditions and their wide variety of colors are unequaled by any other group of shrubs. On the right is the Arnold azalea, a chance hybrid in the Arboretum, having many of the qualities of *Rhododendron obtusum amoenum* but at the same time being considerably more hardy.

Walking toward the old Bussey Mansion we see another planting of the torch azaleas, where one thousand plants have been placed under protecting pine trees. Among these are a few dogwoods, and as we gaze on this scene for a few moments we must admit that unquestionably this torch azalea is the most brilliantly colored of all the plants we have seen on our trip. In fact, as noted in the Bulletin a few weeks back, it is the most brilliant of all the bright colored plants introduced to this country by the Arboretum from Japan. Turning toward the old Bussey Mansion, we see its porch covered with wisteria blooms. The common old-fashioned type, the Chinese wisteria, is at the front and makes the better display, and toward the rear of the house is the lighter colored Japanese wisteria with its longer flower clusters.

Retracing our steps for a short distance only, we walk down the hill among the beeches, admiring the beautiful young foliage of the different varieties, and now and then glancing toward Hemlock Hill at the base of which the first rhododendrons are just coming into bloom. Once more on the road at the foot of the hill some members of the group continue on toward Peter's Hill and the crab apples, some walk among the conifers, and others turn to the right and walk back toward the lilac collection. On our way we walk under an excellent specimen of the silverbell in full bloom, and a few moments later, off to the left, catch a glimpse of brilliant white which is, on close inspection, a perfect specimen of the flowering dogwood, about forty years old, at least twenty-five feet tall, and literally covered with blossoms from top to bottom. With time getting short, we hasten back to the lilacs where several in the group wish to spend the last moments of the trip, making notes and comparisons of these excellent plants to guide them in making their selections for their own homes. It is just for such concrete purposes as this that the thousands of plants in the Arboretum are being continually maintained.

DONALD WYMAN

ARNOLD ARBORETUM HARVARD UNIVERSITY



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THE LIBRARY

WHEN one thinks of the library of the Arnold Arboretum the question naturally arises what is it? How large is it? What sort of books does it contain, and who may use it? Is it open to the public?

First, what is it? It is essentially a botanical library rather than a horticultural one, although it contains many horticultural works. While it has been developed primarily as an adjunct to the study of woody plants, yet it is so catholic in its scope that books on many allied subjects are to be found in it. It was begun in 1873 when Professor C. S. Sargent, the Arboretum's first director, obtained a few standard works needed in planning the Arboretum and arranging its collections.

How large is it? It now includes approximately 43,000 bound volumes, 18,000 photographs, 12,000 pamphlets and several thousand nursery catalogues, thus ranking as one of the three or four largest and most important botanical libraries in America. In 1892 when the library had increased to six thousand volumes Professor Sargent presented it to Harvard University and until his death in 1927 when it numbered more than 37,000 volumes, it was almost entirely his contribution and that of a few of his friends. Since Professor Sargent's death, growth has of necessity been slower, partly because of limited funds. Fortunately through his foresightedness a large proportion of the older important and rare works were procured during his life time, a collection the value of which cannot be overestimated, for it could not be duplicated today, containing as it does thousands of out-of-print works. It is believed to be the largest dendrological library in the world.

Who may use it and how? It is not a circulating library, but primarily a reference collection for the use of the Arboretum staff; however, research workers and others interested in the study of botany are welcomed to the use of the books within the building. Inter-library loans are often made to other universities and to botanical institutions. When loans cannot be made, the library can and does give much help in other ways; it aids visiting students in looking up needed material, and upon request sends out lists of the best books on a certain subject,

verifies references, types short references when the inquirer cannot visit the library, and while there are no facilities for photostat work at the Arboretum, arranges to have it done at the standard price for this service.

The photographs, mounted, catalogued and filed in steel cabinets are also available for consultation. They embrace all the photographs taken by Mr. E. H. Wilson on his trips of exploration undertaken for the Arboretum in eastern Asia, Australasia, India and Africa, and many obtained in the botanical gardens visited by him. A very large number have been acquired by gift, by purchase, and by the later work of Mr. Wilson and other members of the staff. They include photographs of trees and shrubs in the Arboretum and of famous trees in New England, and are arranged in four groups: photographs of men prominent in the botanical and horticultural world, famous gardens, single specimens or groups of specimens, and views taken in the countries explored and in parts of our own country. Where negatives are in possession of the library prints may be made for purchase upon request.

The scope of the library. In the words of Professor Sargent, "Particular attention has been paid to books relating to dendrology, general descriptive botany, the cultivation of trees, the works of travelers in which appear descriptions of trees and of general features of vegetation, and in obtaining complete sets of the periodicals in all languages relating to botany, forestry and allied subjects." Special attention has also been given to acquiring books relating to the history and cultivation of trees and shrubs valued for their economic products, such as tea, coffee, cocoa, oranges and their allies, cinchona, olive, and the mulberry in its relation to silk, since it seemed highly desirable that an arboretum library should contain all possible books on woody plants. Works on paleobotany, plant pathology, physiology and entomology are also included.

The Arboretum takes pride in its comprehensive collections of floras, periodicals and monographs from nearly every nation of the world, more than thirty-five languages being represented. Here the student may find nearly every reference pertinent to his studies. The Russian literature is particularly extensive, probably equaled in America only in the library of the United States Department of Agriculture. The works on Chinese and Japanese botany have attracted students from China and Japan to study the flora of their own country, as in few places is there to be found so complete a collection. The books on economic botany have proved of distinct value to various commercial firms.

The Arboretum owns a nearly complete set of the botanical works of the celebrated Swedish botanist Linnaeus and is fortunate in possessing many of the original Linnaean dissertations which are usually rare items in reference libraries. It has also the "*Viridarium Cliffortianum*," believed to be the only copy in the United States, since the one in San Francisco was destroyed in the earthquake of 1906. For twenty-five years Professor Sargent sought to obtain this small book, which has, perhaps, more of human interest than intrinsic value. Linnaeus, whose "*Species plantarum*," 1753, revolutionized botanical nomenclature, and from which all botanical nomenclature of today dates, was sent to the University of Lund in 1727 to study medicine. Here his inclination for natural history was



PLATE VII

Title-page of Jacquin's "Selectarum stirpium americanarum historia" (cir. 1780).

favored by Professor Strobæus, and he passed three years, 1735-1738, in the house of George Clifort, a rich Dutch gentleman living between Leyden and Haarlem, who employed him to arrange his fine gardens and museum. It was out of a desire to express his gratitude to his benefactor that he honored his memory by a work entitled, "Hortus Clifortianus," of which the "Viridarium" is an abridgement.

The collection of Pre-Linnean books comprises more than 1600 volumes. These are the greatest bibliographical treasures in the library, twenty-six items falling into the group "Incunabula" (cradle books), printed before 1500 when printing was in its infancy. Of these "cradle books" the first acquired by the Arboretum was "Opus ruralium commodorum" by Piero Crescenzi, a book on agriculture; the date is unknown, but was probably soon after 1471. Written before the art of printing was developed, it was, because of its importance, one of the first to be put upon the press. Konrad von Megenberg, "Das buch der natur," 1475, is our earliest and perhaps our most valuable work. A later edition of "Das buch der natur," 1478; Apuleius Platonicus (or Barbarus), "Herbarium," 1484; Columella, "De cultura hortorum," 1480? and Columella, "Hortuli commentarium," 1488-90? are not known to be in any other library in this country.

Other incunabula include Barbaro, "Castigationes Plinii," 1492-93; Bartholomæus Anglicus, "De proprietatibus rerum," 1480 and 1491; "Libri de re rustica," n. d.; "Herbolarium seu de virtutibus herbarum," 1491; "Ortus sanitatus," 1490 or 1497, 1496 or 1487, and 1491; "Gart der gesundheit," 1485; Macer Floridus, "De viribus herbarum," date unknown; "Opera agricolationum," 1482 and 1496; Matthæus Sylvaticus, "Liber pandectarum medicine," cir. 1470 and 1480; Plinius Secundus, "Historia naturalis," 1483 and 1496; Theophrastus Eresios, "De historia plantarum," 148-?: Vincentius Bellovacensis, "Speculum naturale," 2 vol. 1479?, and 3 vol. 1486?; and Lucretius, "De rerum natura," 1486.*

Many editions of these fifteenth century books were published in the sixteenth, seventeenth and eighteenth centuries, and it has been the practice of the library to obtain as many editions of them as possible. It has, therefore, eight editions of Macer Floridus, 1506-1588, with one of 1832; three of Columella's Husbandry, 1551-1745, with one of 1824; seven of Pliny's "Historia naturalis," 1507-1685, with one of 1855-57; sixteen of Theophrastus, 1529-1644, and later, and nine of Crescentius' "Opus," 1534-1745, with one 18—? Of Prospero Alpino there are ten titles and editions, 1592-1745; five editions of Francis Bacon's "Sylva sylvarum," 1627-1670; seven of Bauhin's "Pinax theatri botanici," 1596-1671; nine of Bonnefon's "Jardinier françois," 1653-1684; seven of Van Oosten's *Nederlandse bloemhof*, 1700-1749; twenty-one titles and editions of Richard Bradley on husbandry and gardening, 1716-1757; Brunfels' "Herbarum vivae eicones," of 1530 and 1532, and editions 1532 and 1536 of a second volume; numerous titles and editions by Charles Estienne, 1537-1622; fourteen works and editions by Olfert Dapper, 1668-1703; full collections of the works of

*A fuller description of the incunabula in the library is given in the *Arboretum Journal*, vol. iv. pp. 56-60, 1923.

Dioscorides, Mattioli, Ray, Evelyn's "Sylva," Miller's "Gardener's dictionary" and other gardening books; twenty-one editions of Dodoens' "Cruydeboeck" and other works, 1521-1644; twenty-five works and editions by Leonhard Fuchs' 1531-1572; nine of Herrera's "Obra de agricultura," 1513-1608, and 1819; eleven of Huerto, 1567-1616; sixteen of La Quintinye's "Instruction pour les jardins fruitiers," 1690-1756; eleven of Liger's "Jardinier fleuriste," 1706-1792; six of Tabernaemontanus' "Eicones plantarum," 1588-1731; Ptolemy's "Geographia," 1562; four editions of Manwood's "Treatise and discourse of the lawes of the forest," 1598, 1616, 1665, 1717, and Aristoteles' "Problemata quae ad stirpium genus & oleracea pertinent," 1539. A fine opportunity is thus afforded for the comparison of different issues.

Other books in this group of more than usual interest are Boym's "Flora sinensis," 1556, the first book on Chinese botany published in Europe; Bock's "Kreüterbüch," 1546; Hernandez, "Nova plantarum. . . mexicanorum historia," 1651, the first natural history of the New World; Blake's "Compleat gardener's practice," 1664; Gerard's "Herbal," 1597, containing a manuscript note dating from the time of Shakespeare; "Le grant herbier," cir. 1520; "The greate herball," 1561, and many others. Many of these books are curiously or beautifully bound, and very rare.

The two folios of Dioscorides' "Codex" (1905) in heavy board covers reproduce in facsimile the pages and plates of the famous "Codex" prepared in 512 A.D. for the Princess Anicia Juliana, daughter of the Emperor of the Eastern Empire, which is now preserved in the Hofbibliothek at Vienna. The original is the oldest known manuscript of a botanical work. It was written in the first century of the Christian era. For sixteen centuries this book was considered the highest medical and botanical authority, and was the precursor of modern treatises on botany. There are in the library fourteen editions of works by this Greek botanist.

The period immediately following the 15th century produced many books of special interest which also are to be found in the Arboretum library. Among these are Wagenheim's "Beschreibung einiger nordamerikanischen Holz und Buscharten," 1781, the first book on American trees by a German; Belon's "De arboribus coniferis," 1553, the first book on conifers; a copy of Humphrey Marshall's "Arbustrum americanum," 1785, the first book on American trees written by an American. The most valuable work of Jacquin, an Austrian botanist, is his "Selectarum stirpium americanarum historia," cir. 1780, with hand colored plates. But eighteen (according to some authorities twelve) copies of this work were issued and at the time the Arboretum copy was obtained it was the only one in this country; there are now copies in the library of the New York Botanical Garden and in the Congressional Library in Washington.

A large group of books on roses numbers among its items several of outstanding interest. The earliest work, now very rare, is "Collection of Roses from Nature," by Mary Lawrance, published in London in 1799. There are, with the frontispiece, ninety-one exquisite plates apparently colored by hand. The only other copy known to be in this country is in the New York Public Library. Little

is known of Miss Lawrance except that she was a teacher of drawing, but her book, the first entirely devoted to the rose, will remain always one of the most interesting. In 1802? appeared the second monograph on the rose, "Die Rosen" by K.G. Rössig, published in Leipzig and having fifty colored plates. The Arboretum copy was purchased at the Castle Craig sale in England. H. C. Andrews' "Roses," 2 vols. 1805-28, also with colored plates, is the third of these early monographs and is apparently rare. Two editions of Redouté's "Roses" and all other works known to have been illustrated by this famous artist are among the Arboretum's treasured possessions. A recent work on "the queen of flowers" is the beautiful two volume "Genus Rosa" by Ellen Willmott, with exquisite colored drawings by Alfred Parsons, 1914.

There are 132 shelves filled with works devoted to the study of special families and genera, 36 to economic botany, 21 to medical botany and several to cryptogamic botany.

Of the hundreds of illustrated folios, many of them exceedingly rare and exquisitely illustrated, some have already been mentioned, a few others may be especially noted: Redouté, "Les Liliacees," 1802-16, and "Choix des plus belles fleurs," 1827; Millais' "Rhododendrons," in two series, 1917 and 1924; two editions of Lambert's "Genus Pinus," 1803-37 and 1828; Martius "Flora brasiliensis," 1840-96; Duhamel du Monceau, "Traité des arbres et arbustes," (1800-19); Bonelli, "Hortus romanus," 1772-93; Humboldt, Bonpland, and Kunth, "Nova genera et species plantarum," 1815-25; Sibthorp, "Flora graeca," 1806-40; Curtis, "Flora londinensis," 1777-98; Oeder, "Flora danica," 1761-83; Riocreux, [Collection of 87 original water color botanical drawings], bound in crushed Levant, beautifully tooled, no date; and Palisot de Beauvois' "Flore d'Oware et de Benin en Afrique," 1804-07-[21], excessively rare, the second volume being one of the scarcest botanical works in existence.

A work in seven volumes of very special interest is "The Trees of Great Britain and Ireland" with 419 plates, by H. J. Elwes and Augustine Henry. These volumes were the gift of Professor Sargent's English friends and are autographed by the donors. Each volume is bound in a different wood, the binding of volume one (beech) being taken from a portion of the foundation in Winchester Cathedral in the 13th century, which was removed when repairs were made some years ago. The 740 original drawings made by C. E. Faxon for Professor Sargent's "Silva of North America" are also replete with interest.

More than seven hundred colored plates of Chinese plants executed by native artists more than one hundred years ago form an interesting collection of original paintings. The colors are well preserved and the drawings have an oriental charm. Over six hundred of these plates were the gift of one man.* Some of the plates represent well known plants that have been introduced into this country but many of them are very rare.

One of the most important items in the library from the point of view of the working botanist is the tremendous collection of periodical literature from every country of the world, containing as it does tens of thousands of original papers

*For fuller account see the *Arboretum Journal*, Vol. 11. pp. 131-132. 1930.

basic to proper research. Over four hundred periodicals, transactions of societies, etc. are currently received, with the number of publications from Russia, central Europe and Asia constantly increasing. Nearly 200 of these are received in exchange for the *Journal* and the *Bulletin* of the Arboretum. There are in the library more than 700 complete, or nearly complete, sets of periodicals; among the complete sets are the *Gardeners' chronicle*, the *Botanical magazine* (the oldest serial still in existence, having been published for 150 consecutive years), the *Botanical register*, Loudon's *Gardener's magazine*, Loddiges' *Botanical cabinet* and his trade catalogues, a set of the *Revue horticole*, lacking three early volumes, the oldest garden magazine still published, a set of the rare *L'Horticulteur belge* in five volumes from 1833-1838, and a set of the *Tokyo Botanical magazine* complete with the exception of a few numbers of volumes 2 and 3. There are also Dietrich's *Oekonomisch-botanisches garten-journal* in six volumes 1795-1806, almost unknown in America, a complete set of the *Verhandlungen des Vereins zur beförderung des gartenbaues in Berlin*, the *Annales de l'Institut horticole de Fromont*, 1829-34, and Landreth's *Floral magazine and botanical repository*, 1832-34, a rare American journal.

The collection of works on forestry is unsurpassed in this country, and there is probably not a more complete run of forestry periodicals anywhere in the world, covering as they do all the countries of Europe and Asia and ranging from *Forst-Archiv zur Erweiterung der Forst-und Jagd-Wissenschaft*, 1788, to the new publications as they appear. The Arboretum periodical titles may be found in the "Union list of serials."

Besides the works on botany, there is a large collection of books on travel, among which perhaps the rarest is the French copy of Michaux's *Travels*, a nearly complete set of Rafinesque's works, a large octavo edition of Audubon's "Birds of America" and Captain Thomas Brown's "Illustrations of the American Ornithology of Alexander Wilson and C. L. Bonaparte," folio edition, published in London, 1835. Of the latter work only thirteen copies are known to exist, eight being in the United States.

The Arnold Arboretum library is one of few of the larger botanical libraries in America or abroad whose treasures are made accessible to a very wide public through the publication of its comprehensive library catalogue, in 3 volumes from 1914 to 1933, two volumes listing the works by authors and one by subjects.

To a very remarkable degree this great specialized reference library supplements and completes the other special libraries in and near Boston, such as the Gray Herbarium and the Farlow libraries in Cambridge, and various other units of Harvard University, the Massachusetts Horticultural Society Library and that of the New England Museum of Natural History. Richest and most extensive of all of these within the botanical field, it offers to the seekers of knowledge from printed books on plants and plant science a most unique opportunity. As it stands today it is one of the great botanical libraries of the world, a monument, like the Arboretum itself, to the ability, vision and interest of Charles Sprague Sargent, who made it possible and through whose benefactions it is constantly being increased.

ETHELYN M. TUCKER

ARNOLD ARBORETUM HARVARD UNIVERSITY



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CLEMATIS FOR THE NORTHEASTERN STATES

CLEMATIS has long been neglected in American gardens, and how could it be otherwise when not a single arboretum, botanic garden, or agricultural college in the United States has a representative collection of clematis plants growing on its grounds? It is high time that this state of affairs should be altered, and gardeners everywhere are turning with the new delight of discovery to what the late William Robinson rightly called the most beautiful of all northern climbing plants.

HISTORICAL NOTE

In the 1830's and 1840's gardeners in Boston and Philadelphia were importing new species and varieties of clematis from England almost as rapidly as they were introduced from eastern Asia and elsewhere. *C. florida* had been brought to Europe from Japan over sixty years before it was exhibited at Boston in 1838; but *C. Sieboldii* (*C. florida bicolor*) was exhibited at Philadelphia in 1840 only three years after the plant reached Europe; *C. patens* was exhibited in Boston in 1841 only five years after it reached Europe; *C. lanuginosa* was exhibited in Boston in 1856, only five years behind England; and when the first great hybrid, *C. Jackmani*, was created in England and introduced in 1863, it was shown in Boston by the historian Francis Parkman only three years later. By 1890 the interest had grown to such an extent that a Long Island nursery listed seventy-three varieties of the large-flowered hybrids in a single catalogue.

But then fashion changed, or difficulties in growing the plants intervened, or Quarantine 37 put an embargo on importations; whatever the reason, few clematis were seen in our gardens and few were offered by nurserymen. Perhaps 1928 might be taken as the nadir of American interest in the large-flowered hybrids. In that year, although nearly two hundred named varieties were listed in European nursery

catalogues, an authority like the late E. H. Wilson could write that "altogether there are a score or more of these named varieties, but many are difficult to obtain in this country." Now times have again changed, and in answer to the new wave of enthusiasm for these beautiful plants, new varieties are being imported and made available to American gardeners, though most of them are really old varieties that have been lost to us merely by our indifference.

THE GENUS CLEMATIS

The genus *Clematis* is a member of the buttercup family (which includes such favorites as anemone, columbine, delphinium and peony) and is characterized by opposite leaves, often divided into three, five, or more leaflets, and by a complete absence of petals. The showy portions of the flowers are sepals, and to call them petals is to declare yourself a novice. In a few species, however, such as the American *C. verticillaris* and the European *C. alpina*, the outer row of stamens has been so modified so as to seem more or less petal-like; and in the most charming member of the group, the *C. macropetala* of China and Manchuria, these staminodes, as they are called, would be mistaken for petals by all but the expert. For this reason some botanists regard this group as a separate genus, *Atragene*. Indeed, the species of *Clematis* are so divergent that a few botanists split the genus into three or even four genera, *Clematis*, *Viorna*, *Atragene* and *Viticella*; but this is of little concern to the gardener and is rejected by the vast majority of botanists. I mention it merely to drive home the many-sided richness of this extraordinary genus.

For rich it is, not only in the number of species and varieties, but in its range of size, color, and shape. It includes between two and three hundred species, growing all over the world, on every continent and the islands of the sea, but especially abundant in eastern Asia, the Himalayas, and our own North America. It is found on mountains and in marshes and deserts, and though it grows almost everywhere, even in the Belgian Congo and the Fiji Islands, it is essentially a plant of the temperate zone, and shows its true beauty only in such regions. It includes climbers and non-climbers, ranging in height from twelve inches (as in the *C. Baldwinii* of Florida) to thirty or forty feet (as in the *C. Vitalba* of Europe). Some species are weedy things with inconspicuous flowers, but the vast majority are fit subjects for the garden. In addition to these wildings, about five hundred hybrids have been created by the genius of man, and nearly two hundred of these are still listed by European nurserymen.

Taking the genus as a whole, including both species and hybrids, we find flowers of almost every color, white, gray, lavender, mauve, purple, yellow, pink, scarlet, and red (though not as yet a true red),—of every size, small, medium, and large, with a diameter in some cases

of ten to twelve inches,—and of every shape, flat, tubular, bell-shaped, urn-shaped, lantern-shaped, platter-shaped, single and double, flowers like anemones or apple blossoms or semi-double roses. Nor are the flowers the only attraction. The charm and airy grace of the foliage make it an ornament throughout the growing season; and a new interest is added at seed-time by the fruiting-heads with their feathery styles. In many species these fluffy masses form a display almost as striking as when the plant is in flower.

THE SPECIES

At least forty or fifty species are hardy in New York and New England. Of these only one is in wide use in gardens, the Japanese *C. paniculata*, with its panicles of small, white, fragrant flowers in August and September; but others of the same type, such as the Japanese *C. apiifolia* and the Chinese *C. brevicaudata* and *C. Fargesii*, might be used to produce variety. Little need be said of these except that they lend themselves to much the same uses as screens or over fences, walls, and tree stumps. But it may be worth noting that E. H. Wilson was in error when he said in *More Aristocrats of the Garden* that *C. paniculata* was introduced into the United States by the Arnold Arboretum, from seeds received from Russia; and others (including myself) have repeated the error in print. But Professor Sargent, in an article in *Garden and Forest* in 1890, definitely states that this species was introduced by Thomas Hogg through the Parsons Nursery, of Flushing, Long Island, from which the Arnold Arboretum received its first plant in 1877. "The credit of making this fine plant known to American gardens," says Professor Sargent, "is due to Mr. Edward O. Orpet," who is now, in hale old age, a nurseryman in California.

A selected list of species hardy in the northeastern states is appended to this Bulletin. Of these a few deserve special mention. Loveliest of all is our own *C. texensis*, a native of Texas but hardy in Bar Harbor and Ottawa. A five or six year old plant covered with thousands of its scarlet to rose-pink urn-shaped flowers is as striking a sight as our northern gardens can show. Unfortunately there are drab forms of this species, and care should be taken to obtain a fine strain in which the glowing color of the flower is preserved. Some plants are subject to mildew, which can be controlled by a prompt dusting with Kolodust or powdered sulphur. Other beautiful native climbers are *C. crispa*, *C. troutbeckiana*, *C. Pitcheri*, *C. versicolor*, all with urn-shaped flowers of various shades, and the purple spring clematis of our eastern woods, *C. verticillaris*. Of these *C. crispa* is second in beauty only to *C. texensis*, but inferior species are often palmed off as *C. crispa* by nurserymen. There is a pinkish, trumpet-shaped form which is superior to the rest and deserves a varietal name; I venture to call it *C. crispa cylindrica*, and congratulate the gardener who is successful in obtaining it.

C. montana and its varieties are sure to give the New England gardener heartache, for even the hardiest of them are likely to be killed to the ground, if not entirely destroyed, in an unusually harsh winter. The pink *C. montana rubens* and the white flushed pink *C. montana undulata* are sturdier than the others, but as they flower on old wood and will not bloom if hard hit by "Jack Frost," we can recommend them for this climate only with reservations despite their beauty. Of the several yellow-flowered climbers from China and Korea, *C. tangutica* and its variety *obtusiuscula* are the best. They are sturdy as a rock, these slender climbers with their bright yellow, lantern-shaped flowers, and should be in every garden. Even more beautiful are some of the climbers of the *Atragene* group, the blue *C. alpina* of Europe, the white *C. alpina sibirica* (or *alba*), and especially the *C. macropetala* of China and Manchuria. The last has azure-blue flowers with a mass of tongue-like staminodes that make an unforgettable sight when in full bloom. It may seem fussy at first, but is the reverse of difficult when once established, and it is hardy enough to thrive in Manitoba. Mr. Ernest Markham has recently introduced a fine pink form.

Three small to medium-flowered hybrids, *C. Jouiniana*, *C. Durandii*, and *C. aromatica*, are also attractive plants. I should like to make a special plea for the first, for *C. Jouiniana* (especially the form that grows in my own garden) is a delightful plant, perhaps the easiest to grow of the whole genus. It is a rampant climber, and in late summer it is covered with pale lavender, tubular flowers, which resemble those of one of its parents, *C. Davidiana*. A variety of *C. Viticella* introduced by Lemoine of Nancy, and usually called *C. kermesina*, may easily vie in popularity with *C. montana rubens* when it is better known. It has bright wine-red flowers that cover the plant in great abundance.

Among the low herbaceous species for the flower border or front of the shrubbery are *C. integrifolia*, *C. Davidiana*, and *C. recta grandiflora*, the first two blue, and the last white. Some of our far western species, such as *C. eriophora*, *C. Scottii*, *C. Douglasii*, and *C. Fremontii*, all low plants not over two feet high, with urn-shaped or bell-shaped flowers, are also worth a trial.

THE LARGE-FLOWERED HYBRIDS

The large-flowered hybrids are mainly derived from one European species, *C. Viticella*, and three large-flowered species of Chinese origin,—*C. florida*, brought from Japan by Thunberg in 1776; *C. patens*, brought from Japan by Siebold in 1836, and *C. languinosa*, discovered by Robert Fortune in Ningpo, China, and introduced in 1851. It is by crossing these species, and some of their varieties, that the large-flowered hybrids have been created. The first and still the most popular hybrid, *C. Jackmani*, was first exhibited in England in 1863, and



PLATE IX

Clematis macropetala, a charming Chinese species of the *Atragene* Type, in the azure-blue flowers.

Photo by Donald F. Merrett

since then several hundred have been created in Great Britain, France, Germany, and Holland.

These hybrids are usually classified in accordance with their resemblance to one or other of the parent species. Five types are recognized. These are: (1) Patens Type, blooming in spring on *old wood*; (2) Florida Type, blooming in summer on *old wood*; (3) (4) (5) Lanuginosa Type, Viticella Type, and Jackmani Type, all blooming in summer and autumn on *new wood*. It is useful for the gardener to know to which type a given hybrid belongs, for he then knows the characteristics of the plant and when it will bloom. But it is absolutely essential that he should at least know whether it blooms on old or on new wood, that is, on the wood of the previous year or on the shoots of the current season. All pruning depends on this knowledge, for a plant that blooms on old wood will not flower if it is cut back hard either by the gardener or by "Jack Frost." For this reason varieties that bloom on new wood are in general more adapted to the rather severe climate of the northeastern states.

It should be added that there is a sixth group, the Texensis Type, developed during the 1890's by crossing our native *C. texensis* with various large-flowered hybrids. The Texensis Hybrids are delightful plants, quite different from the other hybrids in shape and color. They are all more or less trumpet-shaped, and of various shades of scarlet and pink, with or without white markings. They are among my own special favorites.

A list representing what in my opinion are the "twenty best" large-flowered hybrids available in this country will be found at the end of this Bulletin. All such choices are of course arbitrary, and my list contains varieties that would not be included if an ampler choice were possible. For the sake of comparison, I have added a similar list made by an English expert of the "twenty best" hybrids obtainable in England. It will be seen that seventy percent of the English list is included in my own, but if I were to have an unfettered choice of the hundred or more hybrids I have myself grown, my final decision would not exactly agree with either list.

I suggest that the novice begin with the varieties that have withstood the test of survival in our climate for many years, such as *C. Jackmani* (purple), Madame Edouard André (purplish red), Madame Baron-Veillard (lilac-rose), Gipsy Queen (dark velvety purple), *C. Henryi* (enormous white), Ville de Lyon (reddish purple), and the somewhat fussier Ramona (blue). The first three are the hardiest of all; the color of Madame Baron-Veillard, never very distinguished, washes out in the sun, but much can be forgiven a plant that refuses to die and that blooms almost without interruption from midsummer to frost. After experimenting with these, the novice, no longer a novice, can try



PLATE X

Clematis "Duchess of Albany," one of the Texensis Hybrids.

Photo by Silvia Saunders

Species	Height	Flowers	Flowering Time	Habitat	Remarks
<i>C. aethusifolia latiseata</i>	6-7 ft.	small, whitish or pale yellow	Aug.-Sept.	Manchuria	
<i>C. alpina</i>	6-7 ft.	nodding, violet-blue	Spring	Central Europe to N.E. Asia	Charming species, which prefers a northern aspect. Blooms on old wood.
<i>C. alpina sibirica</i> (<i>C. s. alba</i>)	6-9 ft.	nodding, white	Spring	Siberia	
<i>C. aromatica</i> (<i>C. coerulea odorata</i>)	6 ft.	bluish violet, fragrant	Summer! Autumn		Hybrid, <i>C. flammula</i> × <i>C. integrifolia</i> ?
<i>C. apiifolia</i>	10 ft.	small, dull white	Sept., Oct.		Similar to <i>C. paniculata</i> .
<i>C. crispa</i>	6-10 ft.	bluish purple, fragrant, urn-shaped	June-Sept.	Va. to Fla. and Tex.	Interesting climber.
<i>C. crispa cylindrica</i>	6-10 ft.	pinkish, trumpet-shaped	June-Sept.		A finer form.
<i>C. Douglasii</i> (<i>C. hirsutissima</i>)	2 ft.	tubular, purple	Spring & Summer	Colo. to Wash.	
<i>C. Durandii</i>	6-10 ft.	open urn-shaped, blue	June-Sept.		Hybrid, <i>C. Jackmani</i> × <i>C. integrifolia</i> .
<i>C. eriophora</i>	1½ ft.	bell-shaped, purple	Spring	Wyo. to New Mex.	Leafmold and partial shade
<i>C. Fremontii</i>	1½ ft.	bell-shaped, purple	Spring & Summer	Mo. to Nebraska	
<i>C. heracleifolia</i>	2-3 ft.	tubular, blue	Aug.-Sept.	E. China	For the flower border or front of shrubbery.
<i>C. heracleifolia Davidiana</i> (<i>C. Davidiana</i>)	2-3 ft.	tubular, blue	Aug.-Sept.	N. China	
<i>C. integrifolia</i>	2-3 ft.	open urn-shaped, blue	June-Aug.	S.E. Europe to W. Asia	For the flower border or front of shrubbery.
<i>C. Jouiniana</i>	10-12 ft.	tubular, lavender	Aug.-Sept.		Hybrid, <i>C. heracleifolia</i> × <i>C. Vitalba</i> . Attractive and vigorous climber; Spingarn variety a superior form.
<i>C. lignisticifolia</i>	20 ft.	small, white	Sept.	Western U.S. & Can.	
<i>C. macropetala</i>	10 ft.	nodding, azure-blue	Spring	N. China & Manchuria	A delightful climber. Pink and white forms exist.
<i>C. montana</i>	25 ft.	open, white	May, June	Himalayas & China	{ <i>C. montana</i> and its varieties bloom on old wood. Not dependably hardy, but <i>rubens</i> and <i>undulata</i> are more robust than the others.
<i>C. montana rubens</i>	25 ft.	pink	June	W. China	
<i>C. montana undulata</i>	25 ft.	white flushed pink	June		
<i>C. montana Wilsoni</i>	25 ft.	white	July	China	
<i>C. ochroleuca</i>	2 ft.	bell-shaped, purple to creamy & yellow	May, June	N.Y. to Georgia	
<i>C. orientalis</i>	20 ft.	yellow	Aug., Sept.	Himalayas to Persia	
<i>C. paniculata</i>	30 ft.	small, white, fragrant	Aug., Sept.	Japan	
<i>C. Pitcheri</i> (<i>C. Simsii</i>)	20 ft.	urn-shaped, purplish	June-Sept.	Indiana to Nebr. & Texas	
<i>C. pseudoalpina</i>	6-8 ft.	nodding, purple to mauve	Spring	Rocky Mts.	Somewhat "fussy."
<i>C. recta</i>	2-3 ft.	small, white, fragrant	June-Aug.	So. Europe	The variety <i>grandiflora</i> has larger flowers.
<i>C. Scottii</i>	1-2 ft.	urn-shaped, purplish	Spring	Rocky Mts.	Prefers well-drained soil and sunny position.
<i>C. serratifolia</i>	10 ft.	yellow	Aug., Sept.	Korea	Often miscalled <i>koreana</i> .
<i>C. tangutica</i>	8-10 ft.	bright yellow, lantern-shaped	June-Aug.	Mongolia to N.W. China	The best of the yellow-flowered climbers.
<i>C. tangutica obtusiuscula</i>	8-10 ft.	bright yellow, lantern-shaped	June-Aug.	N.W. China	
<i>C. texensis</i> (<i>C. coccinea</i>)	6-10 ft.	urn-shaped, scarlet	June to frost	Texas	A superb climber.
<i>C. troutbeckiana</i>	8-10 ft.	urn-shaped, lavender	July-Aug.	Unknown	Floriferous.
<i>C. versicolor</i>	12 ft.	urn-shaped, purplish	July	Mo., Ark.	
<i>C. verticillaris</i>	8-10 ft.	nodding, bluish purple	May, June	Hudson Bay to Va. & Utah	Prefers leafmold and partial shade.
<i>C. Viorua</i>	10 ft.	urn-shaped, reddish purple	Aug.	Penn. to Alabama	
<i>C. virginiana</i>	20 ft.	small, white	July to Sept.	Eastern U. S. to Kansas & Ga.	
<i>C. Vitalba</i>	30 ft.	white, small, faintly fragrant	July-Sept.	Europe	
<i>C. Viticella</i>	10-12 ft.	rosy purple to violet	June-Aug.	So. Europe & W. Asia	
<i>C. Viticella kermesina</i> (<i>C. kermesina</i>)	8-10 ft.	bright wine-red, medium-size	Summer		Attractive climber, introduced by Lemoine.

Nelly Moser (pale mauve with red bar), Prins Hendrik (azure blue), William Kennett (deep lavender), Mrs. Cholmondeley (light blue), and some of the other varieties on the appended list, especially one of the *Texensis* Hybrids, such as the Duchess of Albany. The selection one makes will largely depend on one's color preferences, for there is not a variety on the list that could not grace the proudest garden.

Two double-flowered varieties are now available, Belle of Woking (pale mauve or silvery-gray) and Duchess of Edinburgh (white), both blooming on old wood. Some single varieties, such as *C. Jackmani alba* and Beauty of Worcester, may also surprise us by having an occasional double flower. Something of the airy grace of clematis seems to me lost in the doubles, but Belle of Woking is a superior plant.

SOIL AND SITUATION

The best time to plant clematis is in spring, but the hybrids are usually grown in pots, and these may be set out almost any time during the growing season. The soil should be deeply dug; the deeper and wider the hole the better. This is not the place to discuss the complex problem of clematis and lime, and no one is as yet in a position to say whether lime or the texture of the soil is the essential element. It is sufficient to say that most of the wild species grow in limestone regions. A light loam, moist and well-drained, and with some lime added, is the ideal soil; if the soil is heavy, it may be lightened with leafmold and a little sand; and in the case of all hybrids and most species, it should be enriched with manure,—cow manure preferably on light soils and well-rotted stable manure on heavier soils. Moisture and a cool root-run are essential to the happiness of clematis, and in dry weather they should be given an occasional watering.

Most clematis prefer some shade, which can be provided by planting them behind a shrub or small tree, or if this is inconvenient, they can be given a mulch of spent hops or possibly peat moss sweetened with lime. The ball of roots should be set two or three inches below the surface of the soil, and the stem immediately trained to a stake or post. I protect my own plants with a zinc collar about eight inches high, inserted in the ground two or three inches, for any kink or break in the stem may lead to disaster. I prefer this to the inverted bottomless flower-pot filled with sand that is sometimes used in Europe.

Various methods have been suggested for increasing the sturdiness of the young plants. One method is to peg one of the lower nodes of the stem below the surface of the soil, so that a new mass of roots may be encouraged to grow. Another and more heroic device, in case the plants are not thriving, is to cut the stem at the beginning of the second year below the ground right down to the root, so as to encourage



PLATE XI

Clematis "Belle of Woking," a double-flowered silvery-gray hybrid.

Photo by Walter Beebe Wilder

the growth of new and healthier stems. But with strong plants and the proper soil and situation, neither of these devices need be employed.

PRUNING

William Robinson, one of the greatest of all clematis enthusiasts, once wrote in his crotchety way: "By giving up all pruning trouble is saved, and one gets a more picturesque result." In the case of many of the wild species this is perhaps advisable, and in the case of the hybrids, at least in our climate, "Jack Frost" often takes the matter out of our hands. But more and larger flowers are usually the result of judicious pruning when this is possible.

The problem depends mainly on whether a plant blooms on old or on new wood. With Belle of Woking, Duchess of Edinburgh, Sir Garnet Wolseley, and other hybrids of the Patens and Florida Types, which bloom on old wood, little pruning is necessary except the cutting out of dead wood, but it may sometimes be advisable to trim the plant and cut out some of the growths for the sake of appearance even if some bloom is thereby lost. As for the varieties that bloom on new wood, the general rule is to cut back hybrids of the Viticella and Jackmani Types to within two or three feet of the ground, while only the more robust of the Lanuginosa Type should be treated in this way. The Texensis Hybrids, like *C. texensis* itself, solve the problem for themselves by dying to the ground each winter, so that one need merely cut off the dead canes. It should be remembered that some of the wild species, such as *C. montana rubens* and *C. alpina*, also bloom on old wood, and require the treatment accorded to all old wood bloomers. But it will be found that every species and hybrid, and even every situation, requires special treatment, and that these general directions may need some modification in each case.

USES

Clematis fulfill the general purposes of all climbing plants, in serving as screens, draping fences, walls, trellises, and pergolas, and covering old tree stumps. Nothing makes a lovelier picture than a fine hybrid variety in full bloom against the side of a house. Many of the species can be used in the wild garden, and some of the lower sorts can be used to advantage in the rock garden, as described in the *English Gardeners Chronicle* of November 9, 1935. One of the most charming ways to grow the climbers is to plant them on the shady side of a shrub or small tree, and let them scramble through the branches into the sunlight. They can be used in pots and tubs for house decorations or for the conservatory. They can also be used in beds, twining about branches set slantwise near the ground, with bulbous plants set out between them to furnish bloom in spring. They make admirable cut flowers, some of the varieties lasting ten days or more in



PLATE XII

Clematis "W. E. Gladstone," a fine hybrid with flowers of heavenly blue.

Photo by Walter Beebe Wilder

water. It is strange that no American florists have taken advantage of this fact, for some florists in Holland grow a hundred thousand plants exclusively for the cut flower trade.

PROPAGATION

Most of the species can be grown easily from seed, while others, with hard-shelled achenes, do not germinate for many months. *C.tan-gutica*, for example, requires neither skill nor patience, while *C.tex-ensis* does not appear for eight or nine months, and some of the New Zealand species require one or two years. I have found it best to sow the seeds in the greenhouse as soon as they are ripe, but they can also be sown in a coldframe either in autumn or in spring.

The hybrids can be propagated by layering, by grafting, or from cuttings. Grafted plants are usually inferior to own-root plants, and the latter should be procured whenever possible. The best way to propagate from cuttings is to bring the plants into the greenhouse early in January, take cuttings from the new shoots as soon as they are ready, immerse them for about twenty-four hours in the new root-forming substance discovered by Dr. Hitchcock and Dr. Zimmerman of the Boyce Thompson Institute, and then insert them in sand until they are rooted. When this method is followed, it makes little difference whether the cuttings are nodal or internodal, though by most other methods internodal cuttings may be preferable.

BOOKS

Ernest Markham's *Clematis, The Large and Small Flowered* (London and New York, 1935) is a useful and practical little book, with a special chapter on "Clematis in America." Moore and Jackman's *The Clematis as a Garden Flower* (London, 1872; revised edition, 1877), though out of date, is still indispensable. Those interested in the species should consult Rehder's *Manual of Cultivated Trees and Shrubs*, Bean's *Trees and Shrubs Hardy in the British Isles*, and Bailey's *Standard Cyclopedia of Horticulture*. The last deals with the large-flowered hybrids also. A complete check-list of the hybrids will be found in the *National Horticultural Magazine*, January, 1935. A list of nurseries offering interesting species and hybrids was published in the *Bulletin of the Horticultural Society of New York*, January, 1936.

J. E. SPINGARN



PLATE XIII

Clematis lanuginosa, a Chinese large-flowered species from which many of the hybrids have been derived.

Photo by Walter Beebe Wilder

APPENDIX
TWENTY BEST LARGE-FLOWERED HYBRIDS
OBTAINABLE IN THIS COUNTRY

Variety	Color	Type
Ascotiensis	azure-blue	Viticella Type
Belle of Woking	double, silvery-gray	Florida Type
Comtesse de Bouchaud	satiny rose	Jackmani Type
Crimson King	bright red	Lanuginosa Type
Duchess of Albany*	[see footnote]	Texensis Type
Elsa Späth	bright blue	Lanuginosa Type
Gipsy Queen	dark velvety purple	Jackmani Type
Henryi	white	Lanuginosa Type
Jackmani superba	dark violet-purple	Jackmani Type
Lanuginosa candida	grayish white	Lanuginosa Type
Lady Caroline Neville	delicate mauve with darker bars	“ “
Lord Neville	dark plum	“ “
Madame Edouard André	velvety purplish red	Jackmani Type
Mrs. Cholmondeley	light blue	“ “
Nelly Moser	pale mauve with red bar	Lanuginosa Type
Prins Hendrik	azure-blue	“ “
Ramona	blue	“ “
Sir Garnet Wolseley	bronzy blue with plum-red bar	Patens Type
Ville de Lyon	reddish purple	Viticella Type
William Kennett	deep lavender	Lanuginosa Type

All bloom on new wood except Belle of Woking and Sir Garnet Wolseley.

It might be of interest to compare with this list a similar one prepared for me a few years ago by a well-known firm of clematis specialists in England, since many of the varieties are the same, and the others will soon be available in this country. This list of the “twenty best large-flowered hybrids obtainable in England” includes: Ascotiensis, Belle Nantaise (delicate lavender), Belle of Woking, Comtesse de Bouchaud, Crimson King, Elsa Späth, Fairy Queen (pale flesh with pink bar), Gipsy Queen, Henryi, Jackmani superba, Lady Northcliffe (deep lavender), Lady Betty Balfour, (deep velvety purple), Lasurstern (deep purplish blue), Lord Neville, Madame Edouard André, Mrs. Cholmondeley, Mrs. Hope (satiny mauve with darker bar), Nelly Moser, Ville de Lyon, and William Kennett. All these bloom on new wood except Belle of Woking and Lasurstern.

There is only one pure white variety on either list, and other whites worthy of mention are Miss Bateman and The Bride, blooming on old wood, and Madame van Houtte and Marie Boisselot, blooming on new wood. Other beautiful varieties not yet available here are W. E. Gladstone (lilac), Otto Froebel (gray with a lovely flush), Perle d’Azur (light blue), blooming on new wood, and La Lorraine (pink suffused with lavender) and Edouard Desfossé (violet with deeper bars), blooming on old wood.

*Or any other Texensis Hybrid, Duchess of York, Countess of Onslow, Grace Darling, Admiration, all with trumpet-shaped flowers in shades of pink or scarlet.

ARNOLD ARBORETUM
HARVARD UNIVERSITY



BULLETIN
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BARBERRIES IMMUNE OR HIGHLY RESISTANT
TO BLACK STEM RUST OF CEREALS

THE family Berberidaceae contains a great number of ornamental flowering shrubs which are at once pleasing and useful. Bright red persistent berries enrich the beauty of many of the species; and the foliage, which colors brilliantly in the fall, aids considerably in causing the plants to merit the praise of exacting gardeners. Various immune species of *Berberis* and *Mahonia* are worthy of wider use than they now enjoy and should be better known to the general public.

Approximately 140 different species, forms, and hybrids of *Berberis* (including our two native species) have been found to be susceptible to *Puccinia graminis*, a parasitic fungus which in the spring and summer causes the devastating stem rust of cereals.

LIFE HISTORY OF THE STEM RUST FUNGUS

In the fall this fungus forms its thick-walled overwintering spores on the grain stems and stubble, and is often called "black rust" because of the spore color. In spring, the comparatively large and heavy black rust spores germinate and produce much smaller ones, known as sporidia, which are easily carried by air currents. Of the countless numbers of sporidia produced only a comparatively few are by mere chance transported to susceptible hosts. If these tiny sporidia fail to fall on susceptible species of *Berberis* or *Mahonia*, they die and the life cycle of the rust is terminated; but if they fall on susceptible host species, only favorable weather is necessary to produce infection. Following infection small flask-shaped bodies, containing minute spores, first make their appearance just beneath the surface of the upper epidermis of the leaves. Soon after their formation orange cluster cups are formed on the under surfaces of the leaves, within which are pro-

duced chains of large aeciospores ; an average-sized barberry bush can produce more than 64,000,000,000 of these spores at one time. Only these aeciospores can effect initial spring infection on the cereals in the northern States. We have here a fungus that has five distinct spore forms during a complete life cycle. In addition, it has an interesting requirement involving alternate hosts ; the barberry is necessary for one stage, while the important cereals, such as wheat, oats, barley, and rye, must be present for another stage.

HISTORY OF BARBERRY ERADICATION

The barberry-cereal relationship of the fungus that causes stem rust was first demonstrated on a scientific basis in 1865 by the celebrated German scientist Anton de Bary. More than a hundred years earlier New England farmers observed that rust was more severe on grains growing near barberry bushes, and they voluntarily eradicated their barberries for the specific purpose of protecting grains from the damaging effects of the disease. About this time many laws were passed, both in this country and in Europe, condemning barberry bushes because they caused "blasting" of the grains. The earliest recorded legislation of this kind was enacted in Rouen, France in 1660. In 1726 Connecticut passed a law requiring that all barberry bushes growing in the vicinity of grain fields be destroyed, and similar action was taken by the Massachusetts legislature in 1754. Unquestionably the empirical knowledge of the barberry-rust relationship expressed both by New England farmers and by husbandmen on the Continent led de Bary to make his study. It is this destructive disease of wheat and other cereals that makes current knowledge of the rust-immune species of the Berberidaceae so important from a horticultural standpoint.

In 1918, when nearly 200 years had elapsed after the first laws were passed condemning barberries in the United States, the first organized eradication program was undertaken. During this period certain species of barberry, particularly *Berberis vulgaris* L., became firmly established throughout the northern part of the United States. As the number of these bushes increased in the important grain growing areas there was a corresponding increase in the number and severity of stem rust epidemics.

With the beginning of the cooperative barberry eradication program nearly 20 years ago, thirteen of the north central States, namely, Colorado, Illinois, Indiana, Iowa, Michigan, Minnesota, Montana, Nebraska, North Dakota, Ohio, South Dakota, Wisconsin, and Wy-

oming, passed laws restricting the propagation and distribution of rust-susceptible species. These States were further protected by a Federal quarantine (No. 38 revised) which provides that no plants, cuttings, stocks, scions, buds, fruits, seeds, or other plant parts capable of propagation, of the genera *Berberis*, *Mahonia*, or *Mahoberberis* shall be moved or allowed to be moved interstate from any State of the continental United States or from the District of Columbia into any of the protected states, "unless a permit shall have been issued therefor by the United States Department of Agriculture, except that no restrictions are placed by these regulations on the interstate movement either of Japanese barberry (*Berberis Thunbergii*) or any of its horticultural varieties, or of cuttings (without roots) of *Mahonia* shipped for decorative purposes and not for propagation." In addition to the above named states, Missouri, Pennsylvania, Virginia, and West Virginia are now actively engaged in an eradication program.

IMMUNE TYPES

Fortunately, there are twenty-seven species of *Berberis* and three species of *Mahonia* which have been found to be either immune or of such a high degree of resistance to rust that they can be grown anywhere without endangering our cereal crops. Indeed, the choice of species is so ample and of such quality that the immune species will fulfill most of the purposes for which barberries are used in ornamental plantings.

The following barberries can be grown anywhere in the United States without restriction.¹

B. Thunbergii

B. Thunbergii var. *purpurea*

B. Thunbergii var. *Maximowiczii*

B. Thunbergii f. *minor*

B. Thunbergii var. *pluriflora*

B. Thunbergii f. *erecta*

Permits are required under the regulations of the black stem rust quarantine (No. 38 revised) for interstate movement of the following immune or highly resistant species or varieties into any protected State, and for such movement from any protected State into any protected State. Application for such permits should be addressed to the Division of Domestic Plant Quarantines, Bureau of Entomology and Plant Quarantine, U.S. Department of Agriculture, Washington, D.C.

¹The six forms listed here all have conspicuous fruit, and are winter hardy in the Arnold Arboretum.

Evergreen

*B. burifolia*³
*B. candidula*³
*B. Chenaultii*³
B. Darceinii^{1,3}
*B. Gagnepainii*³
*B. Julianae*³
*B. sanguinea*³
*B. Sargentiana*³
*B. stenophylla*³
*B. triacanthophora*³
*B. verruculosa*³
M. Aquifolium^{1,2}
M. nervosa^{1,3}
M. repens^{1,2}

Deciduous

*B. aemulans*²
B. Beaniana^{1,2}
B. circumserrata^{1,2}
B. concinna^{1,2}
B. dictyophylla f. *albicaulis*³
*B. Edgeworthiana*²
B. Gilgiana^{1,2}
B. koreana^{1,2}
*B. mentorensis*²
B. Potanini^{1,3}

¹ Bearing conspicuous fruit.

² Winter hardy in the Arnold Arboretum.

³ Require winter protection at the Arboretum and in northern States.

All species, varieties, and hybrids of *Berberis* or *Mahonia* not listed in the foregoing groups are prohibited shipment into the protected States or from any protected State into any protected State, and permits will not be issued for such shipment.

DECIDUOUS SPECIES

***Berberis Thunbergii* and varieties.** This species has long been a favorite and is found in nearly every lawn and garden. It is also extensively used for hedge plantings. Thunberg, sometime previous to 1784, was the first European to notice this barberry in Japan, erroneously referring to it as *B. cretica* L. In 1821 A. P. DeCandolle assigned the currently used binomial *B. Thunbergii* to it. It was introduced to Russia sometime before 1874 by E. von Regel, who received seeds from Japan at the Imperial Garden at St. Petersburg. These plants grown in Russia by E. von Regel eventually produced seed and from this source seeds were received at the Arboretum on January 14, 1875.

A compact form of the species originated at the Arnold Arboretum as a chance seedling sometime before 1900. It has smaller leaves, shorter internodes, more slender and delicate branches, a better rounded growth habit, and more dwarfed stature. This form is now known as *Berberis Thunbergii* f. *minor*. Although not cultivated extensively as yet, it does, however, hold a well-deserved position in many shrub plantings; its leaves color well in the fall and the red berries remain attached during the winter.



PLATE XIV

Berberis koreana a hardy barberry already available from some nurseries
and a worthy successor to the old-fashioned *B. vulgaris*.

The form *B. Thunbergii* var. *purpurea*, very widely known, differs from the type principally in the purplish to reddish color of the leaves; the fullest and most brilliant color develops on plants grown in full exposure to the sun.

Berberis Thunbergii var. *Maximowiczii* is characterized chiefly by more twiggy branches, purple bark, and acute leaves which are green beneath. Seed of this variety was sent by the Imperial Botanic Garden, Tokyo, Japan, to the Arboretum in March 1901.

The name of the form called *B. Thunbergii* var. *pluriflora* is somewhat confused. The varietal name *pluriflora* should be applied to *B. Thunbergii* plants which bear three or four flowers and fruits at the end of a short peduncle. Unfortunately, this name has often been applied to the hybrid *B. ottawensis* (*B. Thunbergii* \times *B. vulgaris*), having *B. Thunbergii*-like leaves and bearing flowers and fruits in racemes and umbels. This hybrid is equally as undesirable as *B. vulgaris*.

A new and superior selection of *B. Thunbergii* has recently made its appearance. Mr. M. Horvath of Mentor, Ohio, during his work on one of the large estates in the city of Cleveland, discovered a plant of *B. Thunbergii* with a strong tendency toward erect growth. He gathered the seeds from this plant and from their progeny selected seed from the most upright type. This process was repeated until the fifth generation, wherein Mr. Horvath found what he considered the perfect spire-like plant that he was seeking, properly called *Berberis Thunbergii* f. *erecta*. Unfortunately, this plant has had the erroneous polynomial *B. Thunbergii* var. *pluriflora erecta* applied to it. It is not a selection from a *pluriflora* type, but is a derivative of the typical form of *B. Thunbergii*. This selection is upright in growth and is admirably adapted for formal hedge plantings. It is propagated vegetatively and produces abundant red berries; the foliage changes to a brilliant red in the fall.

B. mentorensis. Through the hybridizing efforts of Mr. Horvath another barberry was introduced to the trade in 1934. *Berberis mentorensis* is the result of crossing *B. Thunbergii* with *B. Julianae*. The cross was made in 1924, and the hybrid which appeared in 1925 is propagated vegetatively. This hardy, three-fourths evergreen plant shows strong resemblance to both parents. The young branches are at first purplish to light brown, angled and strongly grooved; the elliptic-ovate leaves which cover the bush to the ground are coriaceous in texture, dark green above and pale beneath; the margins are sparsely spinulose-dentate, and the apex of the leaf is tipped with a little spine. The plants in the Arboretum are apparently becoming

well established, and this year for the first time are covered with flowers; one fascicle examined contained over forty blossoms. In size and color the flowers closely resemble those of *B. Thunbergii*. When established, the strong growth of this distinctive shrub, armed with stiff spines, is very suitable for protective and ornamental hedges, while it may also be used as a specimen or in natural growing group plantings. In the autumn many leaves assume a pinkish to reddish tinge, later becoming somewhat bronzed. A few leaves remained attached and green during the entire past winter in the Arboretum. Where evergreen barberries fail to withstand rigorous winters, this plant will usually survive, for during the unusually cold winter of 1933-34 it withstood temperatures greater than -20° F. in Ohio without any apparent injury.

B. Gilgiana. Several outstanding barberries which have been growing for many years in the Arboretum will very probably become well known within the next few years. The silky-leaved *Berberis Gilgiana* is one of these. It is a tall hardy plant with spreading branches and pleasing proportions. The young branchlets are grooved, slightly pubescent, and yellow or purplish brown. The elliptic-obovate or mostly oblong leaves are finely pubescent above and more conspicuously so beneath. Abundant yellow flowers are borne in dense racemes on slender puberulous peduncles. In the fall the oblong-ovoid fruits are at first somewhat greenish in color, but change first on the sun-exposed side to pinkish hues and finally to a lovely deep blood red. The foliage also colors handsomely in the fall. The fine specimen on the Overlook in the Arboretum is from seed collected by Purdom (No. 589) and received from China in February 1911.

B. circumserrata. Another Chinese barberry which has much merit but is little known, is *Berberis circumserrata*. It develops into a rounded bush up to 6 feet high and has a stiff twiggy habit of growth. The leaves are somewhat papery in texture, and color brilliantly in the autumn. The large ellipsoid-oblong fruits which taper to a distinct style are yellowish-red in color and are borne singly or in groups of three to five, prominently supported by rigid peduncles and strong pedicels. The fruit persists well through the winter. This is a hardy, handsome shrub of a distinctive type.

B. koreana. From Korea comes a hardy barberry of outstanding character. Seeds of *B. koreana* were first sent to the Arboretum by T. Uziyama in 1904. Our plant is upright in growth habit and has now attained a height of 6 feet. The clusters of large globose-ovoid red fruit persist over the winter. They combine with the reddish to dark

brown branches and the many leaf-like spines of the same color to produce an interesting plant during the dreary winter months. In the spring and summer new interest comes with the yellow flower clusters and the development of the large, rounded, thick paper-like leaves which take on a deep red color, and other hues, in the autumn. In recent years a number of nurseries have propagated this plant, and although a considerable proportion of the seedlings produce plants of upright growth there will be an appreciable number of less desirable growth forms. This hardy barberry is a fit type to replace *B.vulgaris* wherever hedges or individuals of that habit are desired.

B. concinna. Our *Berberis concinna*, which was received from the Royal Botanic Gardens, Kew, in March, 1885, failed to withstand the New England climate. It is reported, however, that at Kew, *B.concinna* forms a low bush of 3 feet in height, of close compact habit. Its leaves are lustrous green above, white beneath, obovate in shape, an inch or less in length, and petiolate, with the midrib ending in a sharp spiny tooth. The solitary, pendant flowers are deep yellow and a half-inch in diameter. The fleshy berries are red. This plant was introduced to Kew by Sir Joseph Hooker from Sikkim about 1850. Under suitable climatic and soil conditions it is a very lovely barberry, distinct because of the vivid whiteness of the under surface of the leaves.

B. aemulans. The hardy, but quite uninteresting *Berberis aemulans* was introduced to the Arboretum in 1908, from seed collected by Wilson in western China.

B. Edgeworthiana reached England about 1845; but the earliest plants at the Arboretum came from seed sent by Mr. R. M. Parker in 1920 from India, where it is native. The species, like *B. aemulans*, apparently has little to recommend it from a horticultural standpoint.

B. dictyophylla f. albicaulis. Graceful and of slender habit, *Berberis dictyophylla* f. *albicaulis* is unusual and charming because of the dense snow-white bloom covering the new shoots and the under surface of the leaves. This form apparently turned up by chance as a minor segregate of *B.dictyophylla*, grown at Hesse's nursery at Weener, Germany, shortly before 1916. The species is native to southwestern China. Most of the flowers are solitary and rather inconspicuous. The fruit is not abundant enough for ornamental value, but this is unimportant in view of the graceful sprays of lovely white stems and the chalky under-surfaces of the leaves, which make a splendid display in both summer and winter. The plant is not hardy at the Arboretum, but it can be grown south of Washington, D.C., or somewhat farther north if given sufficient winter protection.



PLATE XV

Berberis circumserrata, another handsome shrub of distinctive habit.

B. Beaniana. Trim, slow-growing *Berberis Beaniana* has withstood the New England climate since 1923. This species was introduced to England in 1904, seeds being collected from western Szechuan, China, by a Veitch expedition. The plants at Kew were first reported to have flowered and fruited in 1914. It is not surprising then that the plant at the Arboretum, received from Kew Gardens, England, in April, 1923, has failed to blossom until this year when a few flower clusters appeared. Judging from flowering and fruiting herbarium specimens, this will be a very attractive species from a horticultural standpoint. It has reddish, angled branches, small elliptic-lanceolate leaves which are whitish beneath, and it bears panicles of yellow flowers which are followed by long, purple fruits covered with bloom.

B. Potanini is closely related to *B. Beaniana*, but it is less hardy. This species, like the above, is native to China. Our plants which fail to survive the local climate were grown from seed received from Kew Gardens in February, 1927. *B. Potanini* is remarkable for its numerous long spines. The somewhat leathery or rigid, lanceolate to ovate leaves are armed with from 1 to 4 spiny teeth on each side and are whitish beneath. The flowers are produced in racemes, and the fruits are subglobose, red, and tipped with a short style. It should be of distinct value farther south.

EVERGREEN SPECIES

B. Darwinii, a native of Chile, it is not hardy at the Arboretum; it is root hardy but not top hardy at Washington, D. C. In milder climates, as along the Pacific Coast, *B. Darwinii* thrives. This beautiful evergreen was discovered by Charles Darwin in 1835 while on his famous voyage on the *Beagle*. In 1894 it was introduced to cultivation by William Lobb for the Messrs. Veitch, Chelsea, England, from the Island of Chiloe. When grown under suitable conditions. *B. Darwinii* is a plant of great beauty, especially when laden with a profusion of deep orange blossoms early in the spring. In the autumn when it is burdened with a large crop of bluish berries it is also very attractive, and at all seasons the small holly-like leaves produce a pleasing effect.

B. stenophylla. The beautiful, graceful hybrid *Berberis stenophylla* (*B. Darwinii* \times *B. empetrifolia*) first appeared in the nursery of Fisher & Holmes of Hansworth, near Sheffield, England, about 1880. Under conditions such as obtain in the milder parts of England it grows to a height of 8 to 10 feet, is evergreen, and has a graceful habit which neither parent possesses. In addition it has the floral beauty of *B.*

Darwinii and the added hardiness of *B. empetrifolia*, for in April and May it is blanketed with rich golden blossoms. In New England, the plant loses most of its leaves in winter and does little more than cling to life. The Arboretum specimen, which dates from 1884, is scarcely more than 2 feet in height. Even the milder weather of Washington, D. C., is not sufficient to bring out its potential beauty. Probably, then, only in the regions where *B. Darwinii* thrives will this gorgeous plant come into its own.

B. buxifolia. Another evergreen species from South America, this plant is approximately as hardy as *B. stenophylla* and like it has just managed to survive at the Arboretum where it has been growing since 1884. This species was introduced to England about 1826 by Anderson, the botanical collector who went with Captain King's expedition to survey the Magellan Straits. It will form a tall bush (up to 10 feet) of erect stiff habit. The leaves are leathery or hard in texture, the flowers are borne one or two in a fascicle, and the globose fruits are dark purple.

B. triacanthophora. China has produced several of our hardiest, most useful evergreen barberries. The most attractive, *Berberis triacanthophora*, is one of our hardiest evergreens and is a graceful shrub with spreading branches which are well armed with strong slender spines. The narrow leaves are of a clear bright green color above and somewhat whitish beneath. They are borne in almost flattened whorls which aid in giving the shrub a distinctive airy lightness that is very pleasing. This plant was collected by Wilson and sent to the Arboretum in 1907.

B. Julianae. One of our hardiest and strongest growing evergreen barberries is *B. Julianae*. This species was sent to the Arboretum by Wilson in 1908. It is the tallest and most vigorous of the Chinese group, remarkable for its dense, glossy, dark green, luxuriant leaves. The stiff, yellowish gray, somewhat angled stems, armed with vicious spines, make it particularly valuable for protective hedges. The fascicles of yellow flowers are followed by ovoid fruits which are bluish-black, covered with bloom, and have a short but distinct style.

B. Sargentiana. The much less hardy *B. Sargentiana* has rounded slender branches which are graceful in comparison with those of *B. Julianae*. The young branches are reddish in color, and the leaves, which are much longer and wider than those of the foregoing species, are closely spiny-serrate and firmly coriaceous in texture. The yellow flowers are borne in fascicles. The ovoid fruits are bluish black with a slight bloom and with a sessile stigma. Wilson sent this species to

the Arboretum in 1908, but it had been introduced to England by Veitch in 1907.

B. Gagnepainii. The undulating margins of the firm, dark green, narrow leaves of *Berberis Gagnepainii* give this species a distinctive appearance. The spreading branches are well armed with three-parted spines one-half to three-quarters of an inch long which, together with the sharp forward-pointing teeth set in the margins of the linear-lanceolate leaves, provide it with unusually effective weapons of self-defense. It is a native of Szechuan, China, and was introduced for the Messrs. Veitch, Chelsea, England, by Wilson about 1904. Our first plant came from Chelsea in 1908. This species bears large yellow flowers in clusters of about six or sometimes more in the axis of each whorl of leaves. The fruits are long, oval, black berries covered with a bluish bloom.

B. verruculosa. The warty branches of *Berberis verruculosa* account for the specific name of this species, which is a sturdy, dwarf, evergreen shrub. The leaves are leathery in texture, lustrous green above and white beneath, and the recurved margins are armed with a few spiny teeth. The plant is suitable for rock gardens, edges of shrub border, and fronting foundation planting. Carefully pruned it will form spiny green domes which are very attractive. This fine evergreen surely is worth the trouble of winter protection and the necessary pruning because of its lovely form and color. The large golden flowers are solitary or in few-flowered fascicles. The berries are black and covered with bloom. The species was introduced into England by Wilson in 1904 from western China; five years later Wilson sent seeds directly from China to the Arnold Arboretum.

B. candidula. The less hardy *B. candidula* was first collected by Farges in 1894, and in 1895 was raised from seed by M. Maurice de Vilmorin in France. Although it has been growing at the Arboretum since 1929, it scarcely more than remains alive even with considerable winter protection. It is a dwarf evergreen shrub with smooth arching branches. The tufts of small leaves, borne in the axils of the stiff three-parted spines, are dark shining green above and show a vivid blue-white color beneath. It produces large, yellow, solitary flowers. The species is suitable for rock gardens, but will thrive only under mild climatic conditions.

B. sanguinea. From the mountains of Szechuan, China, *Berberis sanguinea*, was introduced to France by M. Maurice de Vilmorin in 1898. The specific name refers to the color of the flower stalks and sepals. It is an evergreen shrub that will attain a height of 6 to 9



PLATE XVI

Berberis Gilgiana, hardy in Boston and valued for its fruit and autumn color.

feet. The pale grayish, smooth branches are armed with long slender spines and bear tufts of leaf clusters. The leaves are deep green in color, linear-lanceolate in shape, tapering to a fine point, and the margins are armed with sharp, forward-pointing teeth. The fascicles of golden yellow flowers, with the sepals reddish on the outside, are borne on reddish stalks of unequal length. The berries are small and blue-black in color.

B. Chenaultii is a hybrid concerning the origin of which no definite information is available. The name suggests, however, that it may have originated in the nursery of Léon Chenault et Fils, Orleans, France. The plant appears to be a hybrid of *B. Gagnepainii* and *B. verruculosa*. The branches are verruculose, which is characteristic of the latter species, and the medium long, somewhat undulating leaves suggest the former. In stature it is intermediate between the two, and although slightly is scarcely an improvement on either species.

All of the evergreen barberries need more or less winter protection in New England either to survive our worst winters or to insure against possible injury during milder ones. It is necessary to cover the ground sufficiently to prevent freezing of the roots, thus permitting the replacement of water lost by the plants through transpiration.

It may be timely to suggest the futility of trying to obtain immune species from seed obtained from an arboretum, or any other place where the different species grow in close proximity. Hybridization, which takes place very readily, will be responsible for many disappointments. Seeds gathered from immune species in such a place will probably give rise to hybrids susceptible to attack by the rust fungus, so one should obtain species of known and dependable purity for real satisfaction. Barberry plants of dependable ancestry can usually be obtained from nurserymen who hold Federal permits to ship immune barberries into protected States, since such permits are not issued until their nurseries have been freed of all susceptible bushes.

Our other native immune members of the Berberidaceae are thus far restricted to three species of the genus *Mahonia*. The members of this genus have unarmed stems, pinnate evergreen leaves, and generally form handsome undershrubs or, rarely, small trees. The dwarf, creeping *Mahonia repens* is native to the Rocky Mountain region, while the low-growing *M. nervosa* and the taller upright *M. Aquifolium* are native to the Pacific Northwest.

Mahonia repens is very useful as a ground cover, especially under trees and shrubs or in locations not subjected to the full rays of the sun. It thrives without an abundance of moisture and requires very

little attention after it is once well established. Its shapely foliage, its abundance of yellow flowers early in the spring, and the bluish fruit in the fall make the plant an ideal cover for areas that might otherwise be bare and unsightly.

M. Aquifolium. The taller *Mahonia Aquifolium*, Oregon-grape as it is known in its native habitat, is a beautiful plant which likewise enjoys considerable shade; in fact, it grows better under such conditions than in the open. These two species are not only of much ornamental value to the home surroundings but for soil erosion and wild-life conservation they will surely serve a valuable purpose. The sheltering leaves and branches aid in the protection of wild life and the edible fruits contribute to the subsistence of birds and other animals.

M. nervosa is a handsome, low-growing plant with lustrous, rigidly coriaceous leaflets armed with spiny teeth. The stem bears conspicuous, persistent lanceolate bud scales which are 2 to 3 cm. long. The bright yellow flowers are borne on erect racemes 8 inches or more in length. The fruits are rounded oblong, small, and of purplish blue color.

Mahoberberis Neuberti, a cross between *Mahonia Aquifolium* and *Berberis vulgaris*, is very susceptible to black stem rust. This hybrid has often been erroneously called *B. ilicifolia*.

In view of the increasing number of States excluding susceptible species of *Berberis* and *Mahonia*, it becomes more and more desirable for all nurserymen interested in barberries to rid their nurseries of rust-susceptible plants and to establish a stock of the immune species sufficient for normal horticultural requirements.

Only recently four additional States (Missouri, Pennsylvania, Virginia, and West Virginia) have asked to be included in the area protected by Quarantine No. 38 (revised). If this expansion in the protected area is made there will be 17 states in which the interstate shipment (into or between) of susceptible species of barberry is prohibited by Federal quarantine. All these States are now cooperating with the United States Department of Agriculture in the barberry-eradication program.

Owing to the steadily diminishing market for barberries that are susceptible to attack by the stem rust fungus, many nurserymen are now restricting their stock to immune species, thus becoming eligible to apply for a Federal permit to ship approved species to any point from which orders are received. Customers will automatically assist in the stem rust control program if, when making purchases, they

will restrict their barberry selections to one or more of the rust-immune species described in this bulletin.

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NOTES

Fascicle five of the important "Icones Plantarum Sinicarum" by Doctor Hsen-Hsu Hu and Professor Woon-Young Chun, issued by the Fan Memorial Institute of Biology, Peiping, China, is dedicated to "Alfred Rehder, Associate Professor of Botany and Curator of the Herbarium of the Arnold Arboretum of Harvard University, mentor of our student days." Both authors received a part of their training at the Arboretum.

The present contribution consists of folio plates 201 to 250 with explanatory text in English and in Chinese, and includes illustrations of six species of *Rehderodendron*, a genus dedicated to Professor Rehder.

Fascicle one was dedicated to Charles Sprague Sargent, first Director of the Arboretum; fascicle two to Augustine Henry, famous botanical collector in China; fascicle three to Ludwig Diels, Director of the Botanical Garden, Berlin, Germany; and fascicle four to E. D. Merrill, present Director of the Arnold Arboretum.

The comprehensive "Bibliography of Eastern Asiatic Botany" by E. D. Merrill of the Arnold Arboretum, and E. H. Walker of the Smithsonian Institution, is being published by the Arnold Arboretum, and should be off the press late this fall or early in 1938. This will be a quarto volume of approximately 650 pages. It contains 23,000 author entries appertaining to the area from Tibet to Kamchatka, south to Formosa and Hainan. Practically every language of western Europe is represented, with many thousand entries in Russian, Chinese and Japanese. Each entry is provided with a brief abstract. Publication was rendered possible by three special gifts to the Arboretum. The preparation of the manuscript covered a period of ten years.

ARNOLD ARBORETUM
HARVARD UNIVERSITY



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VIBURNUMS

THE beauty and interest of many a shrub border is greatly enhanced by viburnums. These plants are most serviceable, and every outstanding shrub garden should include at least a few in one place or another. A good selection of viburnums will provide interest in the garden during the whole year, since several are valued for their flowers in the spring, others are valued for their good foliage, and some for their summer fruits. In autumn many are outstanding when covered with bright colored berries, while most of the *Viburnum* species have good autumn coloration. In some species the fruit remains attached throughout the winter.

Thus the viburnums are a group of plants that add interest to the garden throughout the year. Some are common in cultivation while others are still rare. The Arboretum collection contains about seventy species and varieties. These include most of the hardy species and varieties available in nurseries in this country, together with some rare types that are not generally available; some of these are of botanical interest but have little ornamental value. Supplementing those species hardy in New England are a considerable number of species that will thrive only under more favorable climatic conditions farther south.

Sometimes, in considering a large group of plants such as the viburnums, the gardener is apt to lose sight of the wide ornamental possibilities available by a careful selection of species within a single genus. This Bulletin is devoted entirely to a consideration of the viburnums that are hardy in the north. It is hoped that the following data may increase interest in this group of plants and lead to a fuller appreciation of the horticultural possibilities of certain species.

Viburnums for Flower

The first viburnum to bloom in the Arnold Arboretum is *Viburnum fragrans*. Ordinarily, one or two flowers in a cluster start to open early in March, the remaining flowers finally opening in April. Since this species blooms so early in the season, the flowers are often killed by late frosts. Sometimes the flower buds themselves are partly frozen, so that the inflorescences have a blasted appearance when open. Consequently, *Viburnum fragrans* is not of great value in New England although the flowers are very fragrant and certain of the plants have a picturesque upright habit of growth. Farther south, where the possibility of winter injury is less, it is more valuable from a landscape point of view.

The second viburnum to bloom is *V. Carlesii*. It forms a round, broad bush and usually starts to bloom about the last week in April. By the early part of May it is in full bloom. Because of its time of flowering, it is not often injured, and is therefore considerably better for garden use than is *V. fragrans*. It, too, is very fragrant, and its small white flowers (pink in bud) are very similar in size and shape to those of our native mayflower or trailing arbutus. *Viburnum bitchiuense* is a third representative of this group with fragrant flowers. The young plants are very difficult to distinguish from *V. Carlesii*, but as the plant grows older it becomes considerably more loose and open in growth habit, and consequently is not as valuable for landscape planting as is *V. Carlesii*. Unfortunately various American nurserymen ordering seed of *V. Carlesii* from Japan have received seed of *V. bitchiuense*. Because of the similarity of the young plants, it is often very difficult to correct the error.

Two other viburnums are valued for their large, sterile flower clusters and are commonly called the snowballs. The first, *V. Opulus roseum* (*V. Opulus sterile* in the trade) is too common in our gardens. It is the taller growing of the two and the large sterile flowers are borne in round masses of about the same size as those of the ordinary snowball. Unfortunately the leaves, young shoots, and flower clusters are subject to severe infestations of plant lice which materially disfigure all parts of the plant. For this reason, it should not be planted. By far the better of the two, and a form which is not susceptible to infestation by plant lice, is the Japanese snowball, *V. tomentosum sterile* (*V. tomentosum plicatum*). It is not quite as hardy as the common snowball, being killed to the ground as far south as Philadelphia during the severe winter of 1933-34, (though certain individual plants survived without injury) but in normal winters it is perfectly hardy in New



PLATE XVII

Viburnum prunifolium. This plant usually grows with a single leader although it can be treated as a shrub.

England. Besides having large flower clusters, its branches are horizontal, like those of *V. tomentosum*, giving the plant a unique layered appearance, particularly in the winter when the branches are bare. A third snowball, *V. macrocephalum sterile* or the Chinese snowball, is not hardy in the north, but in the south it is very popular for its large round clusters of flowers.

The rest of the viburnums have large flat clusters of flowers, the flowers themselves being very small and creamy white in appearance, very similar to those of Queen Anne's lace or wild carrot. There are a few species, like *V. Sargentii*, which have a few conspicuous sterile flowers on the outside of the cluster, making them slightly more conspicuous than the others. These viburnums are valued for their small flowers. It is true that *V. dentatum*, *V. dilatatum* and *V. pubescens Canbyi* are outstanding when in full bloom because there is always a wealth of flower clusters almost covering the plant, but other than the few species mentioned above most of the viburnums cannot be considered as having conspicuously beautiful flowers. Most of them bloom during May and June.

Viburnums for Fruit

The majority of the viburnums, with the exception of the double-flowered varieties and a few others, have bright colored fruits. They range in color from yellow to red to blue and black with varying intermediate shades. As a group, the viburnums are valued for their fruits more than for any other reason, and a careful selection of them should insure very colorful spots in the garden from late summer until far into the winter. Some of the fruits are simply black like those of *V. acerifolium*. These are not particularly conspicuous, but nevertheless are very attractive to the birds. The fruits of some others, like those of *V. Sieboldii*, are eventually black, but before maturity they are a brilliant red. Since they remain on the shrub for some time while they are so colored, they lend much interest to the plant in the late summer and fall. Enough cannot be said about the good landscape possibilities of *V. Sieboldii*, since it is not only excellent from the standpoint of bright colored fruits and tall often tree-like habit, but it is also a splendid foliage plant. Even after the fruits have fallen, the bright red-colored fruit stalks remain on the plant a long time, lending considerable color to the plant until late in the fall.

Other viburnums, like *V. cassinoides* and *V. Lentago*, have most interesting fruits, since they change in color from green to pink and red to dark blue. Often several of these colors are evident on the same



PLATE XVIII

Viburnum dilatatum xanthocarpum, one of the rare yellow-fruited viburnums.

cluster or even on the same berry. Such a characteristic gives the plant great interest in the fall.

Certain viburnums like *V. Opulus* and *V. trilobum* (*V. americanum*) keep their fruits a greater part of the winter, providing there are not too many birds in the vicinity. Others, like *V. fragrans*, ripen early in the summer, but as these are soon eaten by the birds the color characters of the fruit cannot be counted upon to be of any landscape importance.

Yellow-fruited Varieties

Although most of the viburnums have red or blue fruits, some are yellow at maturity, and it is these that are worthy of more general cultivation. They should not be used in place of the red-fruited forms, but in conjunction with them. There are at least three, all of which are growing in the Arnold Arboretum but none of which are listed by American nurserymen, namely: *V. dilatatum xanthocarpum*, *V. Opulus xanthocarpum*, and *V. Sargentii flavum*. One other, *V. setigerum aurantiacum*, has good orange-red fruits rather than yellow ones. This plant should also be grown. Since the autumn color of the foliage of each species is dark red, the yellow fruits show off to excellent advantage after the foliage has turned color in the fall. A planting of considerable autumn interest might be made by using two plants of the red-fruited *V. dilatatum* back of a single yellow-fruited variety. The growing of these yellow-fruited forms cannot be recommended too highly, both for nurserymen and gardeners themselves. Some growers take the misguided view that since there is no demand for certain rare plants, such plants have no sales value. This certainly should not be true of the yellow-fruited viburnums, for once they have become known to the public, there is no reason why they will not be even more popular than are the red-fruited forms.

Landscape Uses

As a group, the viburnums are vigorous growing shrubs which enjoy a good sunny location and can be used either in mass plantings or as specimens. As a specimen foliage plant, there is probably nothing nicer than *V. Sieboldii* with its dark green leaves and its masses of billowy foliage. The exotic viburnums, particularly, are used as specimens, while the native ones are used considerably in naturalistic plantings. *Viburnum acerifolium* and *V. alnifolium* are two plants which grow better in the cool shade of the woods than they do in the open sun. *Viburnum pubescens Canbyi* also is excellent for naturalistic planting. As a general rule the other species like sunny locations, and when so

situated they will flower and fruit much better than if grown in continual shade.

In the fall, the predominating autumn color of the entire group is red. Some, like *V. prunifolium*, are a brilliant red, while others like *V. dilatatum* are a dull red. *Viburnum acerifolium* has almost a purple autumn color and is probably one of the few members of the group showing no shade of red in the fall. In order to get the best color effects from the foliage in the fall, most of the viburnums should be grown in the full sun, particularly in situations where they are exposed to the warm sun in the late afternoons of September and October.

The species differ considerably in the mature height to which they grow. *Viburnum prunifolium* has a single trunk and is considered a small tree; *V. Lentago* sometimes grows into a small tree. The dwarf variety of the cranberrybush, *V. Opulus nanum*, never gets over 18 inches tall, and is splendid for low rock plantings or for formal edging material around small low gardens. Other species range in height between these two extremes. The chart gives the approximate height of the various species, as they are used in landscape plantings.

Tender Viburnums

In the south there are several outstanding viburnums that are highly valued for garden use. These would include the evergreen *V. japonicum*, *V. odoratissimum*, *V. tinus*, and several of its varieties, *V. rhytidophyllum*, *V. suspensum*, *V. macrocephalum*, and *V. Burkwoodii*. *Viburnum Burkwoodii* has only recently been introduced into the country, but midwestern nurserymen are now growing it in quantity. It is a cross between *V. utile* and *V. Carlesii*. In a protected place in the Arboretum it withstood the severe winter of 1933-34 in splendid condition, but it cannot be grown in the open in New England. South of Philadelphia it is reliably hardy and is fast becoming a favorite for its lustrous green foliage and pretty flowers. It is not as dense and compact in its growth habit as grafted plants of *V. Carlesii*.

DONALD WYMAN

SOME GOOD ORNAMENTAL VIBURNUMS, HARDY IN THE NORTH

	Date of introduction into U. S.	Native of	Time of effective fruit	Color of fruit	Value of fruit	Value of flower	Approx- imate height	For naturalistic planting
<i>V. acerifolium</i>		U. S.	F	black	—	—	6'	*
<i>V. affine hypomalacum</i>		U. S.	F	black	—	—	6'	*
<i>V. alnifolium</i>		U. S.	S	changing red to black	*	—	9'	*
<i>V. bitchiuense</i>	1911 ?	Japan	S	black	—	*	10'	
<i>V. Burkwoodii</i>	1924	<i>V. utile</i> <i>V. Carlesii</i> in England	—	black	—	**	10' ?	
<i>V. Carlesii</i>	1902	Korea	—	black	—	**	5'	
<i>V. cassinoides</i>		U. S.	F	changing red to black	**	—	8'	*
<i>V. dentatum</i>		U. S.	SW	blue	*	**	15'	*
<i>V. dilatatum</i>	about 1865	Japan & China	FW	red	**	*	9'	
<i>V. dilatatum xanthocarpum</i>	1919	Orig. U. S.	FW	yellow	**	*	9'	
<i>V. fragrans</i>	1915	China	S	changing red to black	—	*	9'	
<i>V. Lantana</i>	prior to 1828	Europe & W. Asia	F	changing red to black	*	—	15'	*
<i>V. Lentago</i>		U. S.	FW	black	**	*	30'	*
<i>V. Opulus</i>	prior to 1790	Europe and N. Africa	FW	red	**	*	12'	
<i>V. Opulus nanum</i>	prior to 1880	Orig. in Europe before 1845	—	—	—	—	2'	
<i>V. Opulus roseum</i>	prior to 1771	Cult. in Europe	—	—	—	**	12'	
(<i>V. Opulus sterile</i>)								
<i>V. Opulus xanthocarpum</i>	about 1898	Orig. in Europe prior to 1840	FW	yellow	**	*	12'	
<i>V. prunifolium</i>		U. S.	FW	black	**	**	15'	*
<i>V. pubescens Canbyi</i>		U. S.	FW	black	*	**	9'	*
<i>V. rhytidophyllum</i>	1908	China	F	changing red to black	—	—	9'	
<i>V. Sargentii</i>	1892	N. W. Asia	S	scarlet	**	*	9'	
<i>V. Sargentii flavum</i>	1904	Orig. in U. S.	S	yellow	**	*	9'	
<i>V. setigerum (V. theiferum)</i>	1901	China	F	red	*	—	12'	
<i>V. setigerum aurantiacum</i>	1908	Orig. in U. S.	F	orange-red	*	—	12'	
<i>V. Sieboldii</i>	about 1880	Japan	S	changing red to black	**	*	30'	
<i>V. tomentosum</i>	about 1865	Japan & China	S	changing red to black	**	*	9'	
<i>V. tomentosum sterile</i>	about 1844	Japan & China	—	—	—	**	9'	
(<i>V. tomentosum plicatum</i>)								
<i>V. trilobum (V. americanum)</i>		U. S.	FW	red	*	*	20'	*
<i>V. Wrightii</i>	1892	Japan	S	red	**	*	9'	

* fair
 ** very good
 S summer
 F fall
 W winter
 — no value

Sources for rare woody plants. In connection with some other work, the Arboretum has just completed checking some 1200 nursery catalogues for rare woody plants. If you have difficulty in locating sources for such rare woody plants, write to the Arboretum, and it may be that a source can be located for you.

Note. Arrangements have been made with Mr. Richard Archbold, leader of the Archbold Expeditions to New Guinea, whereby the specimens collected by Mr. L. J. Brass, the Expedition Botanist, will be identified under the auspices of the Arnold Arboretum. Mr. Archbold is about to leave this country on his third trip to New Guinea under the auspices of the American Museum of Natural History and expects to be in the field for about one year.

These Bulletins will now be discontinued until the spring of next year.

Subscription renewals for 1938 are now due. Send the subscription price of \$1.00 to the Bulletin of Popular Information, Arnold Arboretum, Jamaica Plain, Mass., at your early convenience.

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